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Special Committee on the
Development and Improvement
of the Saint Lawrence River.

Proceedings. 1928



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Canada. St. Lawrence River, Special
Committee on the Development and
Improvement of the



Parliament
(THE SENATE OF CANADA)

PROCEEDINGS

OF THE

SPECIAL COMMITTEE

APPOINTED TO INQUIRE INTO

THE DEVELOPMENT AND IMPROVEMENT OF THE ST. LAWRENCE RIVER

With prefatory digest of the evidence adduced and documents fyled

The Honourable C. E. TANNER
Chairman

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1928

TABLE OF CONTENTS

	PAGE
List of documents submitted, but not printed.....	iv
Order of reference.....	v
Appointment of chairman.....	v
Report of committee.....	vi
Historical sketch of international negotiations.....	vii-xv
Digest of committee's proceedings.....	xvi-lxx

PROCEEDINGS OF COMMITTEE AS RECORDED AND PRINTED

LIST OF WITNESSES

Mr. D. W. McLachlan, Engineer in Charge, St. Lawrence Waterway, Department of Railways and Canals, Ottawa, Ont.: On present navigation works.....	1- 22
Mr. J. R. L. Starr, K.C., Toronto, Ont.....	23- 24
Mr. D. W. McLachlan, on the recommended scheme.....	24- 68
Dr. O. D. Skelton, Under-Secretary of State for External Affairs, Ottawa, Ont.: External treaties and agreements.....	69- 96
Mr. D. W. McLachlan, on the economics of the waterway.....	96-121
Mr. A. L. W. MacCallum, Manager and Secretary, The Shipping Federation of Canada, Montreal.....	122-128
Mr. Thomas Harling, President, Messrs. Thomas Harling and Son, Limited, Montreal	128-137
Mr. Thomas W. Harvie, General Manager and Secretary, Montreal Harbour Commissioners, Montreal.....	138-155
Mr. Alex. Ferguson, Assistant General Manager, Montreal Harbour Commissioners, Montreal	155-167
Professor W. W. Goforth, McGill University, Montreal.....	168-189
Mr. Malcolm N. Gillies, Canadian Marine Superintendent, Anchor-Donaldson, Limited, Montreal	190-193
Colonel A. E. Dubuc, Chief Engineer, Department of Railways and Canals, Ottawa, Ont.	194-214
Mr. R. A. C. Henry, Director, Bureau of Economics, Canadian National Railways, Montreal, P.Q.	215-245
Mr. James Playfair, President and General Manager, Great Lakes Transportation Company, Limited, Midland, Ont.	246-260
Mr. D. W. McLachlan, on stream flow and operation and maintenance charges.....	260-263
Mr. Olivier O. Lefebvre, Chief Engineer, Quebec Streams Commission, Montreal, P.Q.	263-280

APPENDICES

1. Memorandum by Messrs. D. W. McLachlan and G. A. Lindsay, in answer to a series of questions by Honourable Messrs. Béique and Reid.....	281
2. Petition from the Quebec Board of Trade, dated May 16, 1928	289
3. Resolution adopted by the Council of the Chamber of Commerce, District of Montreal, May 9, 1928.....	290
4. Various communications read into the record.....	290-293
5. Extracts from transportation economics of the Great Lakes-St. Lawrence ship channel by Mr. Alfred H. Ritter (submitted by Honourable Mr. Béique).....	294-296
6. Statement <i>re</i> value of proposed St. Lawrence waterway as a transportation route by Messrs. D. W. McLachlan and G. A. Lindsay.....	297-338
7. Series of maps illustrative of St. Lawrence-Great Lakes deep waterway proposals.	

DOCUMENTS SUBMITTED BUT NOT INCLUDED IN THE PRINTED RECORD

St. Lawrence Waterway Project—Report of Joint Board of Engineers—With Appendices.

St. Lawrence Waterway Project—Plates to Accompany Appendices C, D and E.

Census of Industry, 1925—Central Electric Stations in Canada.

Grain Elevator Committee, Report of.

Summary of Cost of Moving Grain, Head of Lakes to Seaboard.

Pamphlet intituled "Kingston the Terminal for Deep Water Navigation through the new Welland Canal."

Report of Hearing of a Delegation Waiting upon Dominion Government *re* Kingston as a Terminal Transshipment Port after Completion of the new Welland Canal.

Upper St. Lawrence, The, by Francis King—(Offprint from Queen's Quarterly).

Water Power Bonds, 1924 Edition.

Pamphlet intituled "The Proposed St. Lawrence Development," by J. L. Payne.

Development of the St. Lawrence—A reply by Mr. T. R. Kirkwood to the series of articles appearing in the Montreal *Gazette* under the above title, by J. L. Payne.

Comments on pamphlet intituled "The Proposed St. Lawrence Development."

Memorandum on Canal Traffic.

Graph showing tonnage of through freight in the St. Lawrence canal system, by Mr. Alex. Ferguson.

ORDER OF REFERENCE

EXTRACT *from the Minutes of Proceedings of the Senate of Canada, April 20, 1928.*

ORDERED, That a special committee of the Senate be appointed to inquire into and report from time to time on the matter of the development and improvement of the St. Lawrence river for the purposes of navigation and production of electric current and power and matters incidental to such objects; and that the committee be empowered to send for persons, papers and records, to examine witnesses under oath if deemed necessary, and to employ stenographers and other clerical help subject to approval of the Senate in regard to expenditures; and that the committee be composed of the Honourable Messieurs Beaubien, Béique, Black, Buchanan, Casgrain, Copp, Farrell, Gillis, Graham, Hardy, L'Espérance, Lynch-Staunton, McLennan, McDougald, McMeans, Molloy, Murphy, Pope, Reid, Robertson, Ross (Moose Jaw), Sharpe, Smith, Tanner and Willoughby.

APPOINTMENT OF CHAIRMAN

EXTRACT *from the Minutes of Proceedings of the Committee, April 26, 1928.*

On motion of the Honourable Mr. Reid, the Honourable Mr. Tanner was elected Chairman.

REPORT OF THE COMMITTEE

EXTRACT from *Minutes of the Proceedings of the Senate of Canada.*

THURSDAY, 7th June, 1928.

The Honourable Mr. Tanner, from the Special Committee appointed to inquire into and report, from time to time, on the matter of the Development and improvement of the St. Lawrence River, presented their third Report.

The same was then read by the Clerk, as follows:—

WEDNESDAY, June 6, 1928.

The Special Committee appointed to inquire into and report, from time to time, on the matter of the Development and Improvement of the St. Lawrence River, beg leave to make their third Report, as follows:—

It was considered advisable by the Committee to confine its investigations to obtaining information bearing on this project from every angle, in order to enable those interested in this important matter to arrive at a sound opinion, based on facts presented to the Committee by experts.

The evidence of the witnesses examined, with the memoranda they submitted, your Committee believes brings together a fund of information which should be of the greatest value. This also may be said of the evidence before your Committee in regard to International engagements respecting the navigation of the St. Lawrence.

Your Committee submit herewith the evidence, documents, and other matters produced at hearings, and recommend that, as time did not permit the Committee to hear all the witnesses whose evidence would be of public service, and, as new aspects of the problem studied may in the interval develop, that the Senate, at the beginning of the next Session of Parliament, should consider the advisability of again appointing a Special Committee to continue this inquiry.

Your Committee recommend that they be authorized to have prepared, printed and distributed with the evidence a digest of the Committee's proceedings; and that 900 copies in blue book form and 100 copies in cloth of the proceedings and digest be printed for distribution as the Committee may direct.

All which is respectfully submitted.

CHAS. E. TANNER,
Chairman.

With leave of the Senate,
The said Report was adopted.

A QUARTER CENTURY OF INTERNATIONAL NEGOTIATION*

Joint consideration of questions affecting St. Lawrence and Great Lakes navigation and the uses of the water for power purposes, may be said to date from the suggestion by the United States, in 1902, that an International Waterways Commission should be set up to study such matters. This and subsequent developments will be found set out in the attached chronological statement as reduced from official documents. In such a summary it is of course only possible to present a mere outline of events:—

1902—June 13. The River and Harbour Act passed by the United States Congress requested the President of the United States to invite the Government of Great Britain to join in the formation of an international commission, to be composed of three members from the United States and three who shall represent the interests of the Dominion of Canada.

“Whose duty it shall be to investigate and report upon the conditions and uses of the waters adjacent to the boundary lines between the United States and Canada, including all of the waters of the lakes and rivers whose natural outlet is by the river St. Lawrence to the Atlantic ocean, also upon the maintenance and regulation of suitable levels, and also upon the effect upon the shores of these waters and the structures thereon, and upon the interests of navigation by reason of the diversion of these waters from or change in their natural flow; and, further, to report upon the necessary measures to regulate such diversion, and to make such recommendations for improvements and regulations as shall best subserve the interests of navigation in said waters.”

1903—April 27. Canadian Government by Order in Council recommended the home government to accept above invitation.

1903—October 16. Appointment of United States members of commission: Colonel O. H. Ernst (chairman), Washington; George Clinton, Buffalo, and Prof. Geo. W. Wisner, Detroit, Mich.

1905—January 7. Canadian members appointed by Order in Council: James P. Maybee, Toronto, chairman; W. F. King, Ottawa; Louis Coste, Ottawa. On Mr. Maybee's subsequent appointment to the Board of Railway Commissioners, George C. Gibbons (afterwards Sir George Gibbons), of London, Ont., became chairman of the Canadian section. The headquarters were Toronto and Buffalo, respectively.

1905—June 14. Meeting of the entire commission held at Toronto, at which the following questions were brought to the attention of the commission:

- A. The uses of the waters at Sault Ste. Marie for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries and the protection of the navigation interests.
- B. The uses of the waters of the Niagara river for power purposes, and the regulations necessary to insure an equitable division of the waters between the two countries and the protection of Niagara Falls as a scenic spectacle.

* This historical sketch of international negotiations is by Mr. George W. Yates, assistant deputy Minister, Department of Railways and Canals, and secretary of the National Advisory Committee on St. Lawrence matters, who, at the request of the Committee, also prepared the digest of the Committee's proceedings which follows.

- C. The alleged differences in the marine regulations of the two countries with respect to signal lights, and the advisability of adopting uniform signals for both countries.
- D. The advisability of building controlling works at the outlet of lake Erie, including the effect upon the levels of the lakes and upon their shores, and upon the river St. Lawrence.
- E. The diversion southward by the Minnesota Canal and Power Company, of Duluth, of certain waters in the State of Minnesota that now flow north into the Rainy River and the Lake of the Woods.
- F. The effect of the Chicago Drainage canal upon the levels of lakes Michigan, Huron, Erie, and Ontario, and upon the river St. Lawrence.
- G. Delimiting the international boundary on the international waterways and delineating the same on modern charts.
- H. The suppression or abatement of illegal fishing on the Great Lakes.
- I. The location and construction of common channels.
- J. Regulations to govern navigation in narrow channels.
- K. Protection of shores from damage due to deepening of channels and increased speed.
- L. The transmission of electric energy generated in Canada, to the United States, and vice versa.

The proceedings of the International Waterways Commission in regard to such of the foregoing matters as were finally dealt with by the Commission will be found set out in Sessional Paper No. 19a of 1913.

1909—June 11. Treaty signed between the United Kingdom and the United States of America regarding the boundary waters and questions arising along the boundary waters between Canada and the United States, and setting up the International Joint Commission to succeed the International Waterways Commission. The new body was vested with greater powers than the old. (See evidence of Dr. O. D. Skelton before Senate Committee.)

1913—July 10. Senate of the United States unanimously adopted resolution offered by Senator Townsend of Michigan,

“Requesting the President to enter into negotiations with Great Britain with the view to securing an international agreement for the concurrent or co-operative improvement of navigation in the boundary waters of the United States and Canada, for the advancement of the commerce of the two countries.”

1914—February 24. United States note suggested that a new international agreement would not be necessary for the reason that the Treaty of January 11, 1909, concerning the boundary waters between the United States and Canada enabled the two Governments to make the necessary investigation of the subject by means of the International Joint Commission, upon which body article VIII of the aforementioned Treaty conferred definite jurisdiction in relation to such inquiries.

In conformity to this authority the United States requested that there be referred to the International Joint Commission for examination and report the following questions:—

“In order to secure the most advantageous use of the waters of the Great Lakes, connecting waterways and rivers forming the boundary

between the United States and Canada from the tide-water on the Atlantic coast to the head of the Great Lakes for deep-water navigation and transportation purposes, for fishing purposes and for power purposes, and also to secure the most advantageous use of the shores and harbours on said lakes, connecting waterways and rivers, in connection with such deep waterway navigation and transportation purposes, is it practicable, feasible and desirable for the Government of the United States and the Government of the Dominion of Canada to adopt any plan for the co-operative and concurrent improvement of these navigable and boundary waters, either by concurrent or reciprocal legislation or by special agreement between them to the extent of constructing and developing a deep waterway for ocean-going vessels of ordinary draft throughout said lakes, connecting waters, and rivers?"

No answer to the foregoing despatch is of record, further discussion of the question evidently being postponed until after the war.

1920—January 21. The Governments of the United States and Canada referred to the International Joint Commission for investigation and report, under terms of treaty of January 11, 1909, the question as to what further improvement of the St. Lawrence between Montreal and Lake Ontario was necessary to make the same navigable for deep-draft vessels of either the lake or ocean-going type, what draft was recommended and estimated cost; whether by locks and dams or by side canals, or a combination of the two; what combination of navigation and power was calculated to obtain the greatest beneficial use of the waters of the river; on what basis should the capital cost be apportioned between each country, as well as the costs of operation and maintenance. Questions as to regulation and control were included, also as to effect on the development of the resources, commerce and industry of each country and likely resultant traffic.

For the United States, Colonel William P. Wooten was designated to co-operate in the engineering study, while for Canada the late W. A. Bowden, chief engineer of the Department of Railways and Canals, acted in a similar capacity.

1921—June 24. Messrs Wooten and Bowden reported to the International Joint Commission:—

"That the physical conditions (on the St. Lawrence) were favourable for improvements for navigation which would be permanent, and would have very low upkeep costs;

That improvement of the entire reach from Montreal to lake Ontario for navigation alone would be feasible, but the loss of the power that could be generated as a by-product in some reaches would not be warranted;

That the development of nearly all the potential power in the river, amounting to approximately 4,100,000 horse-power, could be made as co-ordinate parts of the schemes for the improvement of navigation;

That the simultaneous development of such a vast quantity of power would not be a sound economic procedure as a market to take this output is not now in existence and cannot be expected to spring into being at once;

That the sound method of procedure would be to improve for navigation along those reaches where side canals and locks could most

economically be used, and where the development of the power at some future time would not be interfered with by the proposed improvements; and in that part of the river where the construction of locks and dams offered the most feasible means of improving navigation to provide for the development of the incidental power obtainable as a result of the heads created by the dams;

That the improvements undertaken afford a navigation channel 25 feet in depth, with lock sills 30 feet in depth, so built as to permit the eventual enlargement of the channel to that depth;

That the improvement to be secured by the combined development for navigation and for power of the rapids section on the international boundary, side canals around the other rapid sections, and the necessary channel excavation elsewhere."

The estimated cost of the entire work to provide a 25-foot channel and to develop 1,464,000 horse-power was \$252,728,200. The report considered, but did not recommend, plans for power development in the purely national section of the river. In the international section the navigation works were planned for the Canadian side of the river, in the scheme proposed. A more extensive reference to the Bowden-Wooten report will be found on pages 9 and 10 of the complete report of the Joint Board of Engineers on the St. Lawrence waterway project of July 13, 1927. The Bowden-Wooten report was not published in Canada, but was printed in full by the United States as Senate document No. 179 of the second session of the 67th Congress.

1921—December 19. Having considered carefully the engineering recommendations, and having held public meetings throughout Canada and the United States, for the consideration of related transportation and economic questions, the International Joint Commission recommended that the Governments of the United States and Canada enter into an arrangement by way of treaty for a scheme of improvement of the St. Lawrence river between Montreal and lake Ontario, and that the new Welland Ship canal be embodied in the scheme and treated as a part thereof. It recommended that the proposed works be based on the engineering report,

"but that before any final decision is reached the report of the Board, together with such comments, criticisms and alternative plans as have been filed with the commission be referred back to the Board enlarged by other leading members of the engineering profession, to the end that the whole question be given that further and complete study that its magnitude and importance demand."

The Commission also suggested that there be an exhaustive investigation of the extent and character of the damage through flowage involved in the plan of development finally adopted. Readjustment of the boundary where necessary to bring each of the power houses on its own side of the boundary was recommended, also an International Board to construct, maintain and operate such navigation works as were not otherwise capable of efficient and economic handling; that power works be built, installed and operated at the expense of the country in which they are located; that the cost of navigation works for the combined use of navigation and power, over and above the cost of works necessary to navigation alone, should be apportioned equally between the two countries, but that the cost of purely navigation works be apportioned on the basis of the benefits each country would receive from the use of the new waterway.

- 1922—January 6 Transmission of the aforementioned report to the respective Governments. The recommendations of the International Joint Commission will be found on page 11 of the complete report of the Joint Board of Engineers. A full report was printed by the United States Government as Senate document No. 114 of the 2nd session of the 67th Congress.
- 1922—May 17. Note from U.S. Secretary of State to effect that the United States Government would be glad to take up with the Canadian Government the negotiation of a treaty on the basis of the report of the International Joint Commission, or such modifications of it as might be agreed upon, and requested to be informed as to whether the appropriate British and Canadian authorities were disposed to undertake negotiations.
- 1924—January 30. Reply of Canadian Government to U.S. note of May 17, 1922. Reply called attention to the fact that the International Joint Commission recommended that before any work was carried out, the Joint Engineering Board should be enlarged, and should further consider the technical aspects of the problem in detail, and decide upon the plan that should be adopted. Canada was accordingly prepared to appoint additional engineers to enlarge the Joint Engineering Board with a view to the Board undertaking the preparation of a final report covering the engineering features of the whole project, including its cost. The Government of Canada intended, further, to form a committee which would, in consultation with the Canadian members of the Joint Engineering Board, inquire fully from a national standpoint into the wide questions involved, and they hoped shortly to be in a position to take further action on the proposals made by the United States Government.
- 1924—February 27. United States Secretary of State, in reply to the above despatch advised that the United States Government, similarly, would immediately constitute a national committee which in consultation with the American members of the Joint Engineering Board would make adequate inquiry from a national standpoint into the questions involved to the end that the project for the improvement of the St. Lawrence river for navigation and the development of its water power might be carried forward as speedily as possible. The U.S. Government assented to the suggestion that the Joint Engineering Board should be enlarged, and proposed that it should consist of three members representing each country.
- 1924—March 14. The St. Lawrence Commission, appointed by the President of the United States, comprised:—
- Herbert Hoover, Secretary of Commerce, Chairman;
 - Wm. C. Breed, attorney-at-law, New York City, former President, New York Merchants Association;
 - James E. Davidson, Bay City, Mich., Vice-President, American Ship Building Company, Bay City;
 - James P. Goodrich, Winchester, Ind., formerly Governor of Indiana;
 - James R. Howard, Chicago, Ill., formerly President, American Farm Bureau Federation;
 - James D. Noonan, American Federation of Labour;
 - Stephen B. Davis, Washington, D.C., Counsel;
 - Charles P. Craig, Duluth, Minn., Executive Secretary.

1924—April 2. United States Government designated as members of the U.S. section of the enlarged Joint Board of Engineers:—

Major-General Edgar Jadwin, chief of U.S. engineers;
Col. William Kelly, Corps of Engineers;
Lt.-Col. Geo. B. Pillsbury, Corps of Engineers.

1924—May 7. The Canadian section of the proposed enlarged Joint Engineering Board was appointed by Order in Council as follows:—

Duncan W. McLachlan, B.Sc., of the Department of Railways and Canals, Ottawa;
Olivier O. Lefebvre, Chief Engineer, Quebec Streams Commission, of Montreal, and
Brigadier-General Charles Hamilton Mitchell, C.B., C.M.G., B.A.Sc., C.E., of Toronto.

Mr. McLachlan, who was principal assistant to the late W. A. Bowden in his studies of the St. Lawrence project, was named chairman of the Canadian section, and Major-General Jadwin chairman of the American section.

1924—May 7. Appointment of National Advisory Committee for Canada by Order in Council:—

“The committee of the Privy Council have had before them a report, dated May 7, 1924, from the Secretary of State for External Affairs, submitting that the question of improving the navigation on the St. Lawrence waterway so as to provide access to the Great Lakes for maritime commerce, is one of considerable difficulty and complication, and its right decision may be of the highest possible importance to Canada. The project necessarily involves collaboration with the United States of America and the expenditure of very large sums of money. The minutest examination of the problem in all its aspects, economic, technical and international, is not only justified but essential. The International Joint Commission has held hearings on the subject in both Canada and the United States, and has submitted a most elaborate and valuable report; the engineering problems involved have already been the subject of inquiry and report by an international board of engineers, and are to be further investigated by another such board; other technical connected questions are in course of being studied by an interdepartmental committee.

“The minister is of the opinion that it would be in the public interest to constitute a National Advisory Committee to consider generally whether or not the project would, if completed, be beneficial to Canada, whether the benefits which might accrue and the pecuniary returns, direct or indirect, which may be anticipated from it are such as to counterbalance its disadvantages, if any, whether Your Excellency should indicate a readiness to enter into discussions with the United States of America looking towards the negotiation of a treaty for the carrying out of the necessary works, and what should be the character of the stipulations which any such treaty should contain.

“The minister accordingly recommends that a National Advisory Committee be constituted for the purposes aforesaid, the Honourable George Perry Graham, Minister of Railways and Canals, to be chairman thereof, and the following to be its members:

Thomas Ahearn, Ottawa, Ont.

Honourable Walter Edward Foster, St. John, N.B.

Beaudry Leman, B.Sc., C.E., Montreal, P.Q.

Edward D. Martin, Winnipeg, Man.

Honourable Wilfrid Laurier McDougald, Montreal, P.Q.

Honourable Sir Clifford Sifton, K.C.M.G., K.C., Toronto, Ont.

Major-General John William Stewart, C.B., C.M.G., Vancouver, B.C.

Honourable Adelard Turgeon, C.M.G., C.V.O., Quebec, P.Q.

"The committee concur in the foregoing recommendation and submit the same for approval."

1925—February 4. The United States Government advised that the terms of reference as agreed upon by the engineers had been approved and adopted by the Government of Canada.

1925—March 17. Secretary Kellogg informed the Canadian Government that the United States members of the Joint Board of Engineers were being instructed in accordance with the terms of reference agreed on. These instructions to the Joint Board of Engineers will be found in full on pages 4, 5, and 6 of the engineering report of July 13, 1927. They provided, as recommended by the International Joint Commission, for a reconsideration of the Wooten-Bowden engineering report of 1921. In that connection the enlarged Board was asked certain specific questions, including the following:—

1. Is the scheme for the improvement of the St. Lawrence waterway, presented by the Board in its report of June 24, 1921, practicable and does it provide to the best advantage, at this time and ultimately, for the development of the capacities and possibilities of the waterway?

2. What alternative scheme, if any, would be better adapted to secure the ends desired, due consideration being given,—

(a) To any special international or local interests having an importance justifying exceptional consideration; and

(b) To the extent and character of the damage through flooding and the probable effect of the works upon the formation of ice and the consequent effect on the flow of the river?

3. Should the estimates of cost be revised and, if so, what are the revised estimates of cost having regard to alternative schemes?

4. In order to assist either Government to allocate the amounts chargeable to navigation and power, what would be the respective estimated costs for improving the river for navigation alone and for power alone?

5. To what extent may water levels in the St. Lawrence river at and below Montreal, as well as the river and lake levels generally, be affected by the execution of the project?

Other points covered by the instructions had to do with the effect of diversions, including that of Chicago, upon the St. Lawrence watershed, the manner in which construction, maintenance and operation of such of the proposed works as were international might be supervised, whether the Welland Ship canal should be embodied in the scheme and treated as part thereof, and what time might be expected to be consumed in the construction of the waterway.

1926—November 16. Main report of the Joint Board of Engineers made to the Governments of Canada and the United States by the respective sections of the Board. This report was exclusive of appendices and detailed plans and plates, and for that reason it was impossible to give the scheme the consideration which Canadian authorities considered necessary.

1926—December 27. Honourable Herbert Hoover, as chairman of the United States St. Lawrence Commission, transmitted to the President the committee's conclusions on the engineering report, which he summarized as follows:

First. The construction of the shipway from the Great Lakes to the sea is imperative both for the relief and for the future development of a vast area in the interior of the continent.

Second. The shipway should be constructed on the St. Lawrence route, provided suitable agreement can be made for its joint undertaking with the Dominion of Canada.

Third. That the development of the power resources of the St. Lawrence should be undertaken by appropriate agencies.

Fourth. That negotiations should be entered into with Canada in an endeavour to arrive at agreement upon all these subjects. In such negotiations the United States should recognize the proper relations of New York to the power development in the International Section.

1927—January 3. President Coolidge formally presented the Hoover report to Congress, where it was read and referred to the Committee on Commerce. Both the foregoing documents are printed as Senate Document No. 183, 67th Congress, 2nd Session.

1927—April 13. The United States Government intimates that it has adopted the recommendations of the St. Lawrence Commission which deals with the report of the enlarged Joint Board of Engineers, and is prepared to enter into negotiations with a view to the formulation of a convention appropriate to the subject. Asks for views of Canadian Government.

1927—July 12. Canadian Government replies that it will not be in a position to determine its policy on the question until the report of the National Advisory Committee has been received, and that the committee was not in a position to deal with the matter until all the findings of the Joint Engineering Board, including the appendices, were available.

1927—July 13. Complete report of the Joint Engineering Board, with appendices, plates and plans, rendered to the Governments of both countries. These appendices deal with the following aspects of the investigation:—

Appendix "A"—Field investigations.

" "B"—Lake levels and out flows.

" "C"—Detail plans, and estimates of projects.

" "D"—River levels and discharges at and below Montreal.

" "E"—Ice formation on the St. Lawrence.

" "F"—Experiments on the strength of ice.

" "G"—Construction program.

In these appendices, alternatives were presented to the schemes recommended in the main report of November 16, 1926, and attention was invited to the Chrysler Island two-stage project put forward by the Canadian engineers for the international rapids section. In the main report, the upper development of the Canadian two-stage plan was proposed for Ogden island. Upon further consideration and the securing of additional technical information, the Canadian section concluded that the Chrysler Island scheme was the better of the two proposals put forward. This Chrysler Island project is described in paragraphs 121 to 134, Appendix "C." All documents were ordered printed by Canadian Government.

- 1928—January 5. Complete report, with appendices and detailed plans finally available and the National Advisory Committee called to consider the proposals. Senator the Right Honourable George P. Graham having resigned as chairman when appointed to the chairmanship of the Tariff Board, his place was taken by Honourable W. E. Foster, of St. John, N.B.
- 1928—January 11. Report of the Canadian National Advisory Committee, St. Lawrence waterway, made to the Canadian Government.
- 1928—January 31. Canadian Government replies to the United States note of April 13, 1927. Reply based on recommendations of the National Advisory Committee, which report, and the correspondence, will be found set out in the White Paper issued by the Canadian Government during the session of 1928, and printed for circulation. This Paper includes also the views of the Quebec members of the National Advisory Committee who do not agree with the recommendations of the majority.
- 1928—April 14. Order in Council, P.C. 592, passed on the recommendation of the Minister of Justice, referring to the Supreme Court of Canada for hearing and consideration of certain questions in controversy between the Federal and Provincial authorities as to the division of legislative control over, and proprietary interest in, water powers created or made available by the erection of Dominion works for the improvement of navigation, as in the case of the proposed St. Lawrence development. The complete text of this reference will also be found in the White Paper already referred to.

DIGEST OF COMMITTEE'S PROCEEDINGS

CONTENTS OF DIGEST

	PAGE
Physical and Geographical.....	xvii
Present Navigation.....	xviii
Division of Existing Works.....	xix
D. W. McLachlan on present Navigation Works.....	xx
Power Leases extant.....	xxiv
D. W. McLachlan on the recommended scheme.....	xxv
Dr. O. D. Skelton on International Treaties and Agreements.....	xxxiii
D. W. McLachlan on the economics of the Waterway.....	xxxix
A. L. W. MacCallum, Manager and Secretary of the Shipping Federation of Canada....	xl
Thomas Harling, President, Thos. Harling & Son, Limited.....	xli
Thomas W. Harvie, General Manager and Secretary of the Montreal Harbour Commissioners.....	xlvi
Alex. Ferguson, Assistant General Manager, Montreal Harbour Commission.....	l
Prof. W. W. Goforth, McGill University.....	li
Malcolm Neil Gillies, Canadian Marine Superintendent, Anchor-Donaldson Line, Montreal.....	lv
Col. A. E. Dubuc, Chief Engineer, Department of Railways and Canals.....	lvi
R. A. C. Henry, Director, Bureau of Economics, Canadian National Railways.....	lix
James Playfair, President and General Manager, Great Lakes Transportation Company..	lxiii
D. W. McLachlan on Stream Flow and Operation and Maintenance Charges.....	lxvi
Olivier O. Lefebvre, Chief Engineer, Quebec Streams Commission.....	lxvi

PHYSICAL AND GEOGRAPHICAL

The information contained in the following paragraphs is assembled from various official sources as an aid to the understanding of the physical problems involved in the St. Lawrence waterway project.

The Great Lakes are the source of the St. Lawrence, and form with it a waterway system extending from the interior of the continent to the sea. Lake Superior, the uppermost and largest of the Great Lakes, discharges into lake Huron through the rapids of St. Mary's falls and the St. Mary's river. Lake Michigan is connected with lake Huron by the wide and deep strait of Mackinac. Lake Huron discharges into lake Erie through the St. Clair river, lake St. Clair, and the Detroit river. Lake Erie discharges into lake Ontario through the Niagara river. From lake Ontario, the St. Lawrence flows 533 miles northeast to Father Point, which marks its transition into the gulf of St. Lawrence. For the first 115 miles the river forms the international boundary between Canada and the United States; the remainder of its course is through Canadian territory. The city of Montreal is 183 miles downstream from lake Ontario.

The distances by the ordinary vessel routes from Duluth, Minn., and Port Arthur, Ont., at the head of lake Superior, to Kingston, Ont., at the head of the St. Lawrence, are respectively 1,160 and 1,038 statute miles. The distance from Chicago to the head of the St. Lawrence is 1,067 miles.

The fall, at mean stages, between lake Superior and lake Huron is 21 feet. Lake Michigan and lake Huron are of equal level. The fall from lake Huron to lake Erie averages 8.5 feet, taken up in the slopes of the connecting rivers. The fall from lake Erie to lake Ontario is 326 feet, of which approximately 165 feet is represented by the drop at Niagara falls. The fall from lake Ontario to Montreal harbour averages approximately 226 feet, and from Montreal to the sea about 20 feet, the latter distributed throughout the 160 miles of river between Montreal and Quebec.

The distance from the strait of Belle Isle to Port Arthur or Fort William, on the Canadian shore of lake Superior, is 2,217 statute miles, or to Duluth, a United States port at the western end of lake Superior, a distance of 2,339 miles. The distance from Belle Isle to Chicago is 2,243 miles, and from Belle Isle to Montreal, 1,003 miles.

Through navigation from Montreal, at the head of ocean navigation, to Fort William and Port Arthur is afforded by a system of canals and lake and river improvements, involving 1,214 miles of waterway, of which canals and incidental improvements and facilities comprise 74 miles. The difference in level between a point on the St. Lawrence near Three Rivers, where tidal influence ceases, and lake Superior is about 600 feet, of which 553 feet 3 inches is overcome by actual lockage, the number of locks involved being 48. On the completion of the Welland ship canal, the number of locks on the through route will be reduced to 31. Should the projected St. Lawrence development be undertaken under the Canadian two stage plan, the total number of locks would be further reduced to 17.

PRESENT NAVIGATION

Navigation from lake Superior to lake Huron passes through the locks at St. Mary's falls. Channels have been excavated through the St. Mary's river above and below the locks, and through the St. Clair river, lake St. Clair, and the Detroit river, to afford a minimum depth of 20 feet at the lake levels that have been adopted as the standard for improvements. The extreme low stages reached by the lakes during the last few years have been generally below these levels, with the result that, at times, the channel depths between lake Superior and lake Erie have ranged from 18 to 19 feet.

The dredged channels between lake Superior and lake Erie aggregate nearly 100 miles in length, and have been provided mainly by the United States. Reference will be made to the capital cost of these and other works involved in the waterway in a succeeding paragraph.

Navigation from lake Erie to lake Ontario passes through the Welland canal, constructed and operated by the Dominion of Canada. The present Welland canal affords a depth of 14 feet at normal lake levels. The locks are 270 feet long and 45 feet wide, and the length of vessels that can be accommodated is 255 feet.

The new Welland ship canal, under construction by Canada, is 25 miles in length with 7 locks, each having a lift of $46\frac{1}{2}$ feet, and one guard lock. The difference in level between the two lakes is $325\frac{1}{2}$ feet. The locks are 829 feet long and 80 feet wide in the clear. The depth over the sills of the locks is 30 feet to allow for any subsequent enlargement of the canal reaches to that depth. The portions of the canal first placed under contract were excavated to 25 feet, while later contracts provide for 27 feet. The width of the canal prism at bottom is 200 feet.

Navigation on the St. Lawrence river from lake Ontario to Montreal is provided by certain channel improvements and a series of side canals around the rapids, which canals have been constructed and operated by Canada. The locks are of the same dimensions as those of the present Welland canal, already referred to.

It will thus be seen that navigation on the Great Lakes and the St. Lawrence at the present time falls into three categories:—

- (a) Lake navigation, operating normally on 20-foot draft, on and between all of the lakes except Ontario.
- (b) Canal navigation, operating normally on 14-foot draft, between lake Erie ports and Montreal through the Welland canal, lake Ontario and the St. Lawrence river.
- (c) Deep-sea navigation, from Montreal to the ocean.

The completion of the new Welland ship canal will open lake Ontario to upper lake navigation. Lake Ontario will then be separated from deep sea navigation by the 183 miles of St. Lawrence river above Montreal. Looking to the completion of the Welland ship canal in about three years time, steps have been taken to establish a new terminal at Prescott, Ontario, at the head of the St. Lawrence rapids, 119 miles above Montreal, for the accommodation of the large upper lake grain boats which now make their lower terminals at Port Colborne and Buffalo.

Below Montreal the channels between that port and the sea have been dredged to a depth of 30 feet, and a project to provide a 35-foot depth, commenced in 1909, is now about half completed.

The control of the St. Lawrence ship channel below Montreal, and the improvement thereof, is vested in the Department of Marine and Fisheries.

The canals of Canada are under the jurisdiction and control of the Department of Railways and Canals. The provision of harbour terminals and jurisdiction as to height of bridges over navigation streams, as well as the improvement of Canadian channels not directly connected with canal works, is vested in the Federal Department of Public Works.

DIVISION OF EXISTING WORKS

Consideration was given by the committee as to the possibility of constructing an all-Canadian waterway, either from the head of the Lakes or from the foot of lake Ontario through the international section of the St. Lawrence river. In that connection, information was supplied as to the length of existing navigation courses of the Great Lakes system which are to be found on the Canadian side and on the United States side of the border and along the actual international boundary as well. Details of this mileage will be found in Table No. 1, page 283, as supplied by the engineers of the Department of Railways and Canals. There is some little difference in the mileages as between the upbound and downbound courses and as between the use of the Canadian lock at Sault Ste. Marie and the American locks at that point. However, the variation is less than a mile, as will be seen in the following summary of the totals:

LENGTHS IN MILES

Downbound	On Canadian side	On United States side	Along Boundary	Total
Via Canadian Soo Lock.....	481.01	671.39	63.20	1,215.60
Via U.S. Soo Locks.....	477.31	674.49	63.20	1,215.00
<i>Upbound</i>				
Via Canadian Soo Lock.....	488.26	660.99	67.45	1,216.70
Via U.S. Soo Locks.....	484.56	664.09	67.45	1,216.10

The St. Mary's river, 63.60 miles in length, connects lakes Huron and Superior. The channel throughout this river follows the Canadian side for 6.40 miles, and the United States side for 53.60 miles, and along the boundary for 3.60 miles. In this strip of navigation are four United States locks, the two largest of which have a length of 1,350 feet each, a width of 88 feet and 80 feet, respectively, and a depth of 24.5 feet. Another is 800 feet long by 100 feet wide, with a depth of 18 feet, and the smallest of the four is 515 feet in length and 60 feet in width with a depth of 12.6 feet. On the opposite side of the river there is a Canadian lock 900 feet long by 60 feet wide with a depth of 18.2 feet upon the sills. The entire length of this canal is 1.3 miles with a bottom width of 141.67 feet.

The channel provided through the St. Mary's river by the United States government is 21 feet. The actual minimum depth available for vessels in the St. Mary's river is 19.6 feet, and the same limiting depth is to be found in the St. Clair river below.

The Detroit river, connecting lakes Erie and St. Clair, is 31.60 miles in length. This has been improved by the United States government by the provision of up and downbound channels with a depth of from 20.8 to 21.8 feet. The location of this channel is 9.75 miles on the Canadian side, 12.35 miles on the United States side, and 9.50 miles on the actual boundary.

The necessary improvements in lake St. Clair were made by the United States, providing up and downbound channels of 20 feet and 21 feet, the course being entirely on the United States side of the boundary and extending for 18 miles.

The St. Clair river, connecting lakes St. Clair and Huron, is 42 miles in length and the channel provided is on the Canadian side to the extent of only 0·60 mile. The mileage on the United States side of the line is 15·30, and along the boundary 26·10. The depth of the channels ranges from 20 feet to 22 feet. The capital expenditure on these upper lake connecting channels and the United States locks at Sault Ste. Marie amounts to \$44,754,832.83.

The foregoing paragraphs deal with the inter-connecting upper lake channels. It is of interest to indicate the course of the main navigation route throughout the Great Lakes themselves in relation to the international boundary. The course from Port Arthur to St. Mary's river, across lake Superior, covers 258 miles, of which 217 are on the United States side, and 29 miles on the Canadian side. Through lake Huron the entire course of 215·40 miles is on the United States side, as is the 18 miles of channel through lake St. Clair. In lake Erie, on the other hand, 198 miles of the total navigation of 219 miles are on the Canadian side of the boundary, and 21 miles on the United States side. Of the course across lake Ontario from Port Dalhousie to Tibbetts Point (opposite Kingston), 158·25 miles, 76 miles are found on the United States side, and 82·25 on the Canadian.

In the St. Lawrence river itself, in the international section, 58·76 miles of channel is on the Canadian side, 42·74 on the United States side, and 12 miles along the actual boundary. Below the international boundary to Montreal, the remainder of the course, 69·50 miles, is entirely through Canadian territory.

Capital expenditure on the existing navigation works by Canada on the St. Lawrence and Welland canals amounts to \$78,532,697.71, and on the St. Lawrence ship channel below Montreal to \$30,883,845.27.

D. W. McLACHLAN ON PRESENT NAVIGATION WORKS

(Pages 2 to 22)

The first witness examined by the committee was Mr. D. W. McLachlan, engineer in charge of St. Lawrence matters, in the Department of Railways and Canals, and who acted as chairman of the Canadian section of the Joint Engineering Board which last year completed the second and more extended inquiry into the engineering factors involved in the project.

The main wall of the committee room was given over entirely to a display of maps, plans and profiles, by means of which Mr. McLachlan illustrated his remarks, and also was enabled, progressively, to take the committee over the physical features of the proposed undertaking, commencing at lake Superior and following down through the natural course of the waterway to the sea.

The locks and navigation channels at Sault Ste. Marie were built before the dam which now controls, in the river at that point, the level of lake Superior. He explained that this control was a joint arrangement between the two countries, approved by the International Joint Commission, and designed to hold the lake within certain limits. It was found, however, that they could not by any means maintain the level of lake Superior during periods of low flow because evaporation from the lake was found to be so great. However, they did succeed in holding it up somewhat as compared with nature.

Mr. McLachlan stated that shipping preferred the American channels at the Sault because of the foot and a half greater depth, which was a consideration in loading. Before the new American locks were built the Canadian lock had a few inches more depth than the original United States locks, and handled about sixty per cent of the traffic, or about forty million tons a year, which was more traffic than any other lock in the world passed prior to that time. There is now a traffic of about ninety million tons a year through the Sault waterway.

In reply to a question, Mr. McLachlan said the average flow at Sault Ste. Marie was 76,000 second feet with about 9,000 going out at Chicago. There is about 181,000 passing through the outlet from lake Huron, about 206,000 through the Niagara river, and about 240,000 out of the St. Lawrence.

Below the Sault there are in all three channels, the West Neebish and Middle Neebish, two all-American, and one not entirely Canadian. The boundary line crosses the channel and, in some cases, between it and the Canadian shore there is only about 2 feet of water; thus, there is no all-Canadian channel at the Sault.

Asked whether it would be practicable to build an all-Canadian channel there, Mr. McLachlan replied that he had never made an estimate of it and did not think it would be practicable.

There is a gradual movement of gravel down stream from lake Huron, and the dredging of gravel in the river St. Clair at the outlet of the lake has flattened its slope quite seriously in the last 25 years. The Canadian engineers are not in exact agreement with the United States engineers as to the amount this has lowered lake Huron, or as to how much each country has contributed to it. The total flattening of the river in the last 25 years appears to be about eight-tenths of a foot. All the work connected with channel deepening between lake Huron and lake Erie has been done by the American government.

Asked whether an all-Canadian route could be constructed there, Mr. McLachlan stated that such a route could be secured more easily in the Detroit and St. Clair rivers than at the Sault. There was no insuperable difficulty in the Detroit river, but he had never considered it from that point of view.

In reply to a question as to whether there was any understanding between the two countries as to the maintenance of these channels, Mr. McLachlan replied that the American government maintained all the channels, even supplying the lighthouse keepers who have to be stationed on the Canadian side. All the work through lake St. Clair is on the American side and all the work at the outlet of lake Huron also. The Livingstone channel and the Amherstburgh channel are the only extensive works that are on the Canadian side. About eighty per cent of the work between lakes Huron and Erie is on the American side.

Dealing with changes in levels, Mr. McLachlan, in reply to a question, explained that, due to all causes, there was a drop of 1.14 feet in the level of lake Huron, six inches of which was attributable to the Chicago diversion, which also affected lake Erie to the same extent. He estimated also that there had been a loss of nine inches in level in lake Huron due to gravel dredging, and about three inches due to channel enlargement over twenty years.

The physical features of the works between lake Erie and lake Ontario, principally in the Niagara river and the Welland canals, have already been described. A new point touched on by Mr. McLachlan was the difficulty of establishing suitable navigation works over the Niagara escarpment, which require three locks, each with a drop of 47 feet. These three locks are arranged together in flight and twinned; that is, placed side by side in pairs so that boats may be passed on one side while other vessels are ascending on the other. To adjust the locks to the steep hill it had been necessary to design twice as many locks as they would ordinarily build because they had to be together.

To operate the entire canal, it is proposed to develop the flow at one lock. Twice as much water is required for navigation in twin locks as with single locks. If 2,000 second-feet is used at these flight locks, 1,000 second-feet will spill over without being used at the single locks. Rather than waste this water, it was decided to develop 1,000 second-feet and use it for operating bridges and gates from a single power house.

The possibility of large vessels passing in the Welland Ship canal was discussed, and Mr. McLachlan explained that in a canal running north and south there was a good deal of east and west wind, and, if the boats were light, their bows would be up in the air, and they might at times become wind-bound. They proposed to meet that difficulty in certain exposed spots by planting trees. He did not anticipate any such difficulty in the locks because these vessels were afforded the protection of continuous walls.

From Port Weller to Kingston there is open lake navigation; from Kingston to Prescott some obstructions are met. Channels are quite wide and deep from lake Ontario to about Clayton or Gananoque. Below that point channels become very irregular and run through deep granite gorges. To obtain a practical navigation channel at low cost the American side must be used for about two-thirds of the distance between Gananoque and Prescott. A practical 25-foot channel on the Canadian side would cost \$11,000,000 as against one on the American side for about three-quarters of a million.

The drop in level from Kingston to Prescott is about one foot, and the velocity through the American channel two or three feet a second—mostly two feet. With a few improvements, it is possible to obtain a 450 foot channel through to Prescott. At Brockville narrows there is no natural channel on the American side. It swings to the Canadian. Speaking generally, the channel between lake Ontario and Prescott must be on the American side for about two-thirds of the length and on the Canadian side for the other third if the most economical route is to be followed. The mileage would be approximately 40 miles on the United States side and 20 on the Canadian. The present channel is about 350 feet wide. In the interests of safe navigation and to enable vessels to anchor, if necessary, in fog, a 600 foot channel is desirable. One-third of vessel mishaps on the St. Lawrence are believed to occur in this restricted area where vessels run aground in foggy light. To get a 600 foot channel at Alexandria Bay and in Brockville narrows with cribs along one side would cost about \$4,000,000, and, while that was not provided for in the recommended project of the engineers, Mr. McLachlan personally believed it would eventually require to be done.

The present canals run along the north shore of the river from Prescott to Cornwall. Sometimes navigation is in the river, sometimes not.

Descriptive of the sections of the recommended projects between lake Ontario and Montreal harbour, Mr. McLachlan put in the following extract from the report of the Joint Board of Engineers:—

1. The Thousand Islands section (fifth division of the report of 1921), embracing the deep, lake-like reaches of the river, 67 miles in length, from lake Ontario to the first swift water at Chimney point, 3 miles downstream from Ogdensburg, N.Y., and Prescott, Ont.

2. The International rapids section (fourth division of the report of 1921), embracing the 48 miles of rapids and swift water between Chimney point and the head of lake St. Francis.

3. The lake St. Francis section (third division of the report of 1921), extending 26 miles through that lake to the end of deep water at its foot.

4. The Soulanges section (second division of the report of 1921), embracing the 18 miles of rapids and shoal water from lake St. Francis to lake St. Louis.

5. The Lachine section (first division of the report of 1921), embracing lake St. Louis and the rapids and shoals from this lake to Montreal harbour, a length of 23 miles.

The first two sections lie along the international boundary, between the province of Ontario and the state of New York. The remaining three lie in the province of Quebec. The improvement of the Thousand Islands section and of the lake St. Francis section is solely a question of excavating channels for navigation. The other three sections can be improved for power in addition to navigation.

The Thousand Islands section has already been referred to. The International Rapids section includes the entire territory between Chimney point or Johnstown, which is below Prescott, and Cornwall. It includes a drop in the river of about 91 feet, and takes in the Galops canal, the Rapide Plat canal, Farran's Point canal, and the Cornwall canal. All these canals were built by Canada and have been utilized by both Americans and Canadians. They have been toll free since 1903.

Lake St. Francis, between St. Regis and Coteau, is a stretch of water 28 miles long, all in Canadian territory, with a drop of about six inches. The level of that lake is about a foot above its natural elevation. It was raised in 1850 by a couple of dams at the foot of the lake. To secure 25 or 27 foot navigation would be comparatively easy. The international boundary, following the 49th parallel of latitude, leaves the river at St. Regis at the upper end of the lake where the shore, for a short distance, is along the United States boundary. But for that, the control of lake St. Francis would be entirely Canadian.

Between lake St. Francis and lake St. Louis there is a fall of 82 feet in 14 miles. The shores are flat and the material marine clay intersected by a few ridges of rock and hardpan. Improvement of that section would be simple. Following the river there is a fall of 20 feet in the Coteau rapids in about 3 miles, a fall of 32 feet in the Cedar rapids in about 2 miles, in the Split Rock rapids a fall of 7 feet in 3 miles, and a fall of 20 feet in the Cascades over a couple of miles.

In this section is located the present Soulanges canal on the north side with 14 foot navigation, and the old Beauharnois canal on the south side of the river, now abandoned for navigation purposes and utilized for power development. Twenty-five foot navigation could not be provided at the present Soulanges canal except by the construction of a new canal.

Entering lake St. Louis, there was about 10 miles of deep, natural channel until Valois bay was reached. From there to the head of the Lachine canal, about 3 miles, dredging had been found necessary to secure the present 14-foot channel.

At the entrance to the Lachine canal the water surface is one foot below the level of the lake above. The fall from this point to the harbour is about 46 feet which is overcome by five locks. Passenger boats drawing about $7\frac{1}{2}$ feet of water at present run the rapids all the way from Prescott to Montreal without making use of any of the locks or canals. Between Montreal and Quebec the channel is 450 feet wide and 30 feet deep with a deepening to 35 feet about 60 per cent complete. There are about 65 miles of improved channel between Montreal and the sea. The length of this dredged channel is about the same as the total in the St. Mary's, St. Clair, and Detroit rivers, except that there are no two-way channels below Montreal.

In reply to questions, Mr. McLachlan enumerated the power leases outstanding on the St. Lawrence in both the national and international sections as leased by the Dominion government with injury, in some cases, to the use of the canals. These leases, in brief, are as follows:—

POWER LEASES ISSUED BY THE DEPARTMENT OF RAILWAYS AND CANALS AND OUTSTANDING ON THE ST. LAWRENCE RIVER

Location	Lessee	Amount
From Galop canal—		
Cardinal.....	Edwardsburg Starch Co.....	280 H.P. equals 660 c.f.s.
Iroquois.....	M. F. Beach.....	200 H.P. " 219 c.f.s.
Iroquois.....	Corporation of village of Iroquois.....	100 H.P.
From Rapid Flat canal—		
Morrisburg.....	Municipal council of village of Morrisburg.....	20 H.P.
Morrisburg.....	Corporation of village of Morrisburg..	750 H.P.
Morrisburg.....	Corporation of village of Morrisburg..	250 H.P. equals 286 c.f.s.
From Cornwall canal—		
Mille Roches.....	St. Lawrence Power Co.....	Variable—About 1,000 c.f.s. at present.
Cornwall.....	Corporation of town of Cornwall.....	50 H.P.
Cornwall.....	Canadian Cottons Ltd.....	2,440 H.P. equals 1,220 c.f.s.
Cornwall.....	Andrew Hodge (Slomant Electric Light and Power Company and Cornwall Street Railway Electric Light and Power Co.).....	8 runs of stone. (80 H.P.).
Cornwall.....	George Stephen.....	Approx. 100 H.P.
From Soulanges canal—		
Near Cedars.....	Provincial Light, Heat, and Power Co.	Approx. 3,890 c.f.s.
From St. Lawrence river—		
Valleyfield.....	Montreal Cotton Co.....	10,000 c.f.s.
Valleyfield.....	Montreal Cotton Co.....	2,500 H.P.
Valleyfield.....	Montreal Cotton Co.....	6 runs of stone (60 H.P.).
Valleyfield.....	Corporation of town of Salaberry de Valleyfield.....	30 H.P.
Valleyfield.....	Valleyfield Electric Co.....	135 H.P.
From Beauharnois canal—		
St. Timothee.....	Canadian Light and Power Co.....	All water passing through Beauharnois canal (Approx. 5,000 c.f.s. at present time).
From Lachine canal—		
Cote St. Paul.....	St. Paul Land and Hydraulic Co.....	All water except that required for navigation purposes.
St. Gabriel.....	Lease ultra vires—(present occupant John Young and Ira Gould).....	All water except that required for navigation purposes.
From Lachine canal—		
Montreal.....	Ogilvie Flour Mills Co.....	250 H.P. 176 c.f.s.
Montreal.....	" ".....	550 H.P. 388 c.f.s.
Montreal.....	" ".....	500 H.P. when available.
Montreal.....	" ".....	500 H.P. " "
Montreal.....	" ".....	750 H.P. " "
Montreal.....	Pillow-Hersey Manufacturing Co. (Steel Company of Canada).....	4 runs of stone (40 H.P.).
Montreal.....	" ".....	4 " " 40
Montreal.....	" ".....	4 " " 40
Montreal.....	Jas. McDougall (Peck Rolling Mills).....	4 " " 40
Montreal.....	Thos. Peck (Peck Rolling Mills).....	4 " " 40
Montreal.....	James Hervey (Peck Rolling Mills).....	2 " " 20
Montreal.....	James Hervey (Peck Rolling Mills).....	4 " " 40
Montreal.....	W. P. Bartley (Peck Rolling Mills, Record Foundry Company, Dominion Linseed Company).....	12 " " 120
*Cedars rapids.....	Cedar Rapids Manufacturing and Power Co.....	350,000 gallons per second (equals 56,000 c.f.s.) with an additional 19,000 c.f.s. from Nov. 20th to May 20th, of each year.
*Lachine rapids.....	Montreal Heat, Light and Power Co..	The present installed capacity of this plant is 16,000 H.P. used only as a reserve.

* Leases issued by the province of Quebec but authorized by the Dominion Government.

MR. McLACHLAN ON THE RECOMMENDED SCHEME

(Pages 24 to 68)

Having completed his description of the physical characteristics of the present Great Lakes-St. Lawrence navigation system, Mr. McLachlan proceeded, on his second appearance, to outline the scheme of improvement by the Joint Board of Engineers, passing, as on the previous occasion, from the head of the lakes down. The two new American locks at the Sault have $24\frac{1}{2}$ feet at the sills. The engineers have recommended that the channels above and below that point be deepened to 25 feet, which would enable a boat with $23\frac{1}{2}$ -foot draft to navigate those locks and channels. Recently the United States Government had adopted a project to widen one of the two channels there to 600 feet, which would give them one channel of that width and another channel of 300 feet.

The Canadian lock at the Sault was built originally to provide for 20-foot navigation, but owing to causes already outlined—the dredging of gravel, the Chicago diversion, and some enlargements for navigation—the level of lake Huron had been lowered in recent years about $1\frac{1}{2}$ feet.

Between lake Superior and lake Huron there will be about 22 miles of dredging in the one-way channel, all of which will be on the American side. At the outlet of lake Huron it is proposed to steepen up the slope of the St. Clair river which reduces the dredging to a certain extent, and to raise the level of lake Huron one foot by compensating works. The improvement from lake Huron to lake Erie is to be secured largely by dredging. The length of channel to be improved on the St. Clair river is 10 miles, on lake St. Clair 15 miles, and in the Detroit river 16.25 miles, mostly in the Livingstone channel territory. It is proposed to spend \$21,000,000 in St. Mary's river, \$20,000,000 in river St. Clair, lake St. Clair and Detroit river, and about \$700,000 at the outlet of lake Erie at the Niagara river.

Mr. McLachlan mentioned that \$2,700,000 was intended to be spent on compensating works in the St. Clair river at the outlet of lake Huron. The engineers went very carefully into the relative advantages of regulating works and compensating works for the control of the waters of lake Huron. They had found that they could secure all the benefit required by dredging and by compensating works for half the money that regulating works would cost. In consequence they had dismissed the idea of the regulation of the waters of the Great Lakes as advanced by a great many engineers, including those engaged by the city of Chicago. The difference between compensating works and regulating works lay in the fact that the former required the construction of a dam across a river, such as at Sault Ste. Marie, in which there would be gates to be opened and closed as required. Compensating work consisted in the placing of an obstruction in the bottom of a channel in order to deepen its slope. In that way it was possible to raise the high water level just as they could raise the low water level, and they could raise the mean level as much as they could the two extremes. Thus they secured the natural benefit of the fluctuation of the lakes without becoming involved in any of the responsibilities attaching to a structure that could be opened or closed only in accordance with international agreement.

In reply to questions, Mr. McLachlan stated that these remedial works at the foot of lake Huron and the foot of lake Erie would more than compensate for the loss in level due to the Chicago diversion, but they would not overcome the loss due to the Chicago diversion below Montreal, where there would be no dams in the river.

The channel improvements recommended would only enable a boat of about $23\frac{1}{2}$ foot draft to go from port Arthur to Kingston. The engineers' report gives an estimate of the cost of a 27 foot channel which would provide 25 foot navigation between those two places, also the cost of a 30 foot channel

to accommodate boats of 28 foot draft. Mr. McLachlan explained that the United States Government Engineers were opposed to making a channel between lake Superior and lake Erie deeper than 25 feet at present because they thought they would have to turn around and deepen all their harbours, and they were inclined to the view that the best thing to do was not to go beyond the 25 foot depth until a greater depth was found to be actually required. He had observed a news item to the effect that the United States Government was appropriating \$24,000,000 to provide a depth of 23 feet in these interconnecting channels in soft bottom, and 24 feet in hard bottom, so that they might assume that all those channels would be deepened to 24 feet presently, whether the Deep Waterway scheme goes through or not. At present the minimum depth went as low as 18 feet in November of some years. In the spring of the year, or in July and August, a two foot greater depth would probably be available.

Between lake Superior and lake Erie not more than 10 per cent of this channel work would be in Canadian territory, and that would be confined to the Amherstburg channel and part of the Livingstone channel in the Detroit river.

THOUSAND ISLANDS SECTION

Between lake Ontario and Prescott where there was a fall of about one foot they proposed to spend a little over \$1,000,000 in improving it. That channel is partly in Canadian water and partly in the United States. The Canadian channel in that section is so very restricted and crooked that it would cost \$12,000,000 to get a practicable channel from the foot of Howe island, near Kingston, down to Prescott on the Canadian side, whereas a channel just as good can be gotten on the American side for about \$700,000.

From Brockville narrows the channel is on the north side of the boundary close to the Canadian shore. There is no practicable channel on the American side, and it would cost \$5,000,000 to get a channel on the American side, whereas one can be secured on the Canadian side for \$500,000. He felt these estimates to be low in providing accommodation for 600 foot boats, and later investigation by another board of which he was a member made it necessary to increase this estimate of \$500,000 to about \$2,000,000.

INTERNATIONAL RAPIDS SECTION

In the international rapids section, which runs between Johnstown, near Prescott, and the head of lake St. Francis, below Cornwall, there is a fall of about 91 feet. In this section the Wooten-Bowden report recommended a single stage plan of improvement with a control dam near the upper end of the section where there would be a head of about 8 feet in summer and about 1 foot in winter, with a head of 74 feet at the lower end of the section. Their control dam was proposed for Ogden island just above Morrisburg. One objection to that scheme was that the river would still run open in winter. The upper end of the lower section would collect a lot of frazil ice which would destroy 7 feet of head every winter. This was considered to be of great economic importance, and on the basis of coal values the recovery of that loss was estimated to justify an expenditure of \$50,000,000. In consequence, the enlarged Joint Board of Engineers, of which Mr. McLachlan was a member, developed a two stage scheme along much the same lines as the Wooten-Bowden plan, but with the lower level higher and the loss in head at the upper end less.

In the first recommendation of the Joint Board this upper dam was proposed for Ogden Island, but in appendix C. the Board set out an alternative double stage scheme with the upper dam located at Chrysler Island, which the

Canadian section of the Board now believed to be the better proposition of the two. Mr. McLachlan pointed out that the two sections of the Joint Board of Engineers had not been able to reach agreement as between the single stage scheme of development proposed by the United States section of the Board and the two stage scheme preferred by the Canadian section. The upper dam of the two stage scheme made certain an ice cover which avoided formation of frazil, afforded better protection for the banks of the river below, and would control any surges in the river from lake Ontario. The first proposal of a dam at Ogden Island would develop from about 11 feet in winter to 20 feet in summer when first built, and about 17 feet after the main development has been completed at Barnhart Island. If a head of 17 feet were developed at Ogden Island it would reduce the head at Barnhart Island to about 67 feet. In addition to the upper or control dam, a small throttling agency was proposed to be maintained at Galops Island, where it is designed to make an excavation large enough to carry through Galops Island the water that now flows south of the island. Then they would divert the water from the south channels and make their improvement in the dry. After that was done, they would open up everything, but maintain the dam across the artificial channel through the island. The Crysler Island dam, already mentioned, would afford protection should anything happen to the main development below. The Canadian plan was believed to be designed to avoid ice gorging, and that this would be avoided was made doubly sure by the dam it is proposed to leave in for emergency purposes at Galops. With the dam at Crysler and the dam at Galops they really had two agencies which would enable them to keep the river free of ice and unobstructed in the winter.

Another advantage of improving the international rapids section in two stages—a 25-foot development at Crysler Island and a 60-foot development at Barnhart Island—would be, in Mr. McLachlan's opinion, that federal agencies could control the upper plants and operate them as they chose; they could allow private agencies, or other bodies, to build and operate the lower plants. In that way the upper plants could be operated as a base load plant with a uniform sale of power 24 hours of the day. This would enable federal authority to make sure that the flow would be continuous every day in the week and every hour of the day. In that way also they would avoid the danger inherent to a single stage scheme where, to secure uniform power, it would be necessary to have steam plants to take care of peak loads, unless variations of flow were permitted to the annoyance of interests below.

For the main development a dam is projected from the American main land to the foot of the Long Sault, on to the Barnhart power-house, on to the foot of Sheek Island, and up the Canadian main land to about Moulinette, where it connects with land high enough to hold the water of the river. There are some channel enlargements between the Canadian main land and Croil Island, but otherwise the section of the river between Crysler Island and Barnhart Island is large enough to secure velocities of about $1\frac{1}{2}$ feet per second and a smooth ice covering in winter without any frazil formation whatever. With this scheme, the cheapest place, in the opinion of the Joint Board, to put the canal for navigation, past the Long Sault Rapids and down, is on the American side of the river. At Crysler Island it really makes no difference from the standpoint of cost whether the locks are placed on the American or on the Canadian side. The entrance works out a little neater on the American side from the engineering point of view, but so far as any difference in cost is concerned, there would be none. With the Welland canal on the Canadian side and the Quebec section on the Canadian side, the Canadian Engineers thought it would be well to show the proposed works on the American side in the international section, at any rate for preliminary discussion and consideration.

DIFFERENCES BETWEEN UNITED STATES AND CANADIAN PLANS

The differences between the plan proposed by the American section for the international rapids portion of the river and the plan proposed by the Canadian section was stated by Mr. McLachlan as follows:—

“It varies from the plan which we tried so hard to get them to accept, in these respects. We propose a practically complete dam across at Galops island and also have a lock there. They have no lock at all at Galops island, though there are a few small dams across the side channels with a view to meeting that very vital need of throttling the flow if anything happened to their main dam at Barnhart island. They had to fix it so lake Ontario would not flow to the sea for a long period and run down in level, if this big dam or power-house or a bank went out. They varied also from us down at the lower end; they show a dam right across the main channel at the foot of Barnhart island practically opposite the point where we put the power-house, but they go across a different channel. We go across the north channel, north of Barnhart island, and we put the main dam above the foot of the Long Sault where the rock is at elevation 156. They propose to put their main dam across the main channel at the foot of Barnhart island where the rock is about elevation 108, about fifty feet lower than where we put it. They also propose to shorten up the side canal to a considerable extent. They wish to come right out of the lake Ontario level and go through a lock of forty feet lift. Now, we cannot agree to such a bold scheme as that. We lengthen out the canal and place a guard structure about the first lock, so if boats go through the first lock and carry away the gates the only trouble will be that a small quantity of water will escape from a basin and then we will fix up the gates. They think they can provide special apparatus such as swing dams and special apparatus at the lock itself that will take care of an accident at that point. We cannot accept that as sufficiently safe.”

LOCATION OF POWER-HOUSES

As to the location of the power-houses Mr. McLachlan said that, at Barnhart island, the Canadian power-house could be established on Canadian soil if it was decided to spend a little more money, though it would force Canada into a rather awkward location. They could push the power-house down stream to a point where both Canadian and American power-houses would be on the Canadian side of the boundary, or it could be arranged so that the power-houses would be one half on the Canadian side and one half on the American side. That matter had been considered, but it was always assumed that it would be a very easy matter in the treaty to so adjust the line that the boundary could be carried through the centre of the power-houses as recommended. If this were done, the Canadian power units would have employees operating them who would be Canadian citizens standing on Canadian soil and obedient to Canadian laws.

At Crysler island one half the dam is planned for the Canadian side and one half on the American side, and one power-house on each side of the boundary.

WHY THE WORKS WERE PLANNED FOR THE UNITED STATES SIDE

On the question as to why the engineers had planned the navigation canal and the Long Sault dam for the American side, which he considered a fine route for navigation, Mr. McLachlan had a number of reasons:

At the Galops Rapids, in the recommended Canadian scheme in the two stage project, there is no lock, but the channel south of Galops island down past Cardinal is improved. From Cardinal to Crysler island there was open navigation for about 16 miles, the line followed by the boats being sometimes on the Canadian side of the boundary and sometimes on the American side. It could, without much difficulty, be placed entirely on the Canadian side of the boundary but there appeared to be no object in doing so. At Crysler island the short piece of canal and lock could be placed on either side of the boundary for substantially the same expenditure. The entrance and exit from the canal as proposed is held to be a little nicer and neater on the American side, also a shade shorter. At Crysler island, a 25-foot difference in the level was overcome by a side canal and lock. For construction purposes it is necessary to put a 14-foot temporary lock in the dam which could be made a permanency if it was decided to have a large and also a small canal so that 14-foot navigation might be continued through the former.

At the Long Sault, the canal shown is $6\frac{1}{2}$ miles long. There had been objection to a canal of that length, but it was long and straight and provided a maximum of safety for navigation. It passed through level country and material easily excavated. They had good foundation for the upper lock and the same foundation for the lower lock as the American section showed in their scheme. Opportunity was provided to place a guard structure about one mile above the lock, whereby only a small quantity of water would run off if gates were carried away. There was good balance between the area above and the area below and, on the American side, there would be no bridges across the works except the Ottawa and New York railway bridge, which must be provided for.

The building of the canal on the American side made it possible to preserve the present Cornwall canal intact on the Canadian side, because, for construction purposes, it was necessary to build a 14-foot lock to care for the gradual change in level brought about by the work, and the estimates were prepared on the basis of making that a permanency. Thus, even if Canada consented to establish the new and larger works on the American side at that point, there would still be the same facilities for navigation on the Canadian side as at present. Mr. McLachlan showed (page 48) how it would be possible to establish the canal past the Long Sault on the Canadian side at an estimated cost of \$3,500,000 more than the recommended plan. An objectionable feature, however, was that it would cross and render obsolete the entire present Cornwall canal, which seemed serious from the Canadian standpoint. A second and even a third scheme had been considered (page 48), but they were so many millions more costly than the one on the American side that there appeared to be nothing for it but to place the works as recommended on the American side, and he personally felt that this was the place for the new canal. Later, if Canada wanted to build another canal on the Canadian side, she could do so, though, as already pointed out, the present Canadian Cornwall canal could be preserved in the recommended scheme as designed.

It was suggested by a member of the Committee that, if the proposed large canal were placed on the American side, it would be owned, controlled, and operated by the Aluminum Company, a private corporation. In reply to that Mr. McLachlan said that the Aluminum Company were supposed to own all of Barnhart island except two farms which they had not yet secured. So far as he knew they owned very little, if any, of the American main land.

On another aspect of the proposition, Mr. McLachlan explained that the engineers had been asked to report what they would do if there was no navigation to consider and they had to improve for power only, and conversely, what for navigation only if no power was considered, while a third question had been posed as to what would be required to improve for both. They had

answered those questions in their report, in which a scheme for improving the international rapids section for navigation only was shown at an estimated cost of \$79,000,000 (page 51), that canal to follow the American shore. Another scheme for navigation alone would leave the river at Chimney Point and follow the Canadian shore paralleling the Grand Trunk tracks to below Cornwall. Such a canal would cost \$100,000,000.

It was suggested by a member of the Committee that the lower development with its international complications might be avoided. His plan appeared to be a joint development at the upper or Chrysler island location where the physical features lent themselves to a fifty fifty arrangement which would produce 300,000 H.P. for each country, while at the lower development a side canal might be used to divert water from the level above the Long Sault, from which power might be obtained by using the channel north of Sheek island. As to that Mr. McLachlan was of the opinion that the proposed diversion would affect the level of the river in the international rapids section and it would be necessary in consequence to go to the International Joint Committee for approval, so that international questions would still be involved.

THE QUESTION OF FLOODING

One honourable member suggested that if the upper dam were placed at the foot of Ogden island instead of Chrysler island there would be less flooding of land on the Canadian side below. In reply, Mr. McLachlan explained that the reason Chrysler island was preferred was that the head at that point would never drop below 19½ feet, whereas at Ogden island the head would fall to 11 feet in winter, which would make power people extremely apprehensive.

On the question of flooding, Mr. McLachlan said:—

“The back part of the town of Morrisburg is built on land which is well above lake Ontario. There is a certain business section that is low; that is down within about two feet of the water level that we propose in the river. That, consequently, will have to be dealt with. Now, in figuring on this Chrysler island scheme we did this: we first provided for a dyke around Morrisburg at an estimated cost of six or seven hundred thousand dollars. We knew the town of Morrisburg would never be satisfied with such a solution, we knew no one would be satisfied to place the citizens of Morrisburg behind a dyke where they would have to depend on a pump to keep out drainage and care for leaks. On the other hand, we did not want to put a large sum in our estimates and say this should be paid to the town of Morrisburg to knock down that part of the town and rebuild and put it nearer the Grand Trunk railway, or up-stream because the property in that part of the town is not worth as much as the damages that should be paid. So we set about to design better protection and drainage works. We then figured on an egg-shape sewer big enough to carry off the drainage for the whole town, and we figured on building that sewer back of this bank all the way down to below that dam at Chrysler island. That cost is about \$1,800,000 and we put that in the estimate. It is in the estimated cost of the Chrysler island project so if this scheme is executed it would have gravity drainage. With it the town of Morrisburg is in a first class position to say ‘Give us the money and we will knock down all that part of the town and we will move it up the hill and everybody will be happy’. I grant this method of dealing with Morrisburg has boosted the estimated cost of this scheme and possibly better arrangements can be made than the estimate indicates.”

As to this flooding, Mr. McLachlan did not think there would be 1,000 acres below Morrisburg affected on the Canadian side, exclusive of the islands. The dyke was so arranged as to keep the flooded area at a minimum. To do this it was proposed, in part, to relocate the Grand Trunk railway. There would be no swamp land resulting.

In discussing the question of control of the second, or lower dam, Mr. McLachlan said that for navigation alone it could be so established that three quarters of the dam would be in Canadian territory if it were built at the crossing of the rapids, but if they did that and afterwards tried to develop power it would be necessary to excavate a head race from north of Sheek island to a power house at Barnhart island, which would be more costly than using the present natural channel between Sheek and Barnhart islands.

THE NATIONAL SECTION

Mr. McLachlan next dealt with the lake St. Francis section, the north side of which was half in the province of Ontario and half in the province of Quebec, while the American shore touches the lake just at the upper end. The drop between lake St. Francis and lake St. Louis was 82 feet. The first stage of the recommended plan would develop 400,000 H.P. on a 22 foot head by a dam across the river just above Cedars. The second stage consisted of diverting 67,000 second feet overland from the pool above Cedars village to the Ottawa arm of lake St. Louis, developing thereby 500,000 H.P. on a 78 foot head. The third stage would not be approached until the power previously developed had been marketed. This stage consisted of a dam across the river at Cascades island where a 54 foot head would be developed.

That was the proposal that was recommended as being the best for power. They next considered what should be done from the combined standpoint of power and navigation, and, in that connection, it was believed that, rather than build a canal for navigation around the south side of the section overland—a 15 mile overland canal—it would be \$8,000,000 cheaper to build a side canal on the north side of Coteau rapids whereby the Federal Government could develop 40,000 H.P. above Cedars and leave to other agencies, provincial, or licensed companies, the development of the other two stages as required. Mr. McLachlan felt there would be no reason for developing any more power than that in order to get the best navigation.

Mr. McLachlan discussed (page 59 and succeeding pages) at considerable length the alternate possibilities of the north and south shore developments of the lake St. Francis and Soulanges sections, including the proposed improvement from Hungry Bay to Melocheville.

Proceeding, he dealt with the Lachine rapids section between lake St. Louis and Montreal where the Lachine canal, 10 miles in length, overcomes a drop in the river of 46 feet. The improvement in the Lachine rapids section for power would be very difficult and costly. The presently recommended scheme introduced three locks in this section, instead of two as proposed by the Wooten-Bowden report. By putting a lock at the upper end of Nuns island they were able to lower the artificial level north of that island sufficiently to take the drainage that comes out at that point into the basin without passing it over the canal. The first lock is proposed below Victoria bridge, the second at Nuns island, and the third opposite the Verdun asylum and near the river. It passes so close to the river that there would be no bother about bridges and no populated part of the city of Montreal on the river side of the canal. The scheme provides for one tunnel beneath the canal just above the Verdun asylum, as it was thought that some day there would probably be a bridge over the river in that district.

Above the lock at the asylum a guard structure was proposed, as it was found to be an advantage to power interests to raise the level of lake St. Louis about 5 feet higher than in nature, especially in low water. For this purpose, a dam is provided across the crest of the rapids, of the type used in the St. Andrews rapids near Winnipeg—a dam that can be closed in summer and opened in winter. This would not increase the cost of the works for navigation and yet make it easy for power to be developed at a later date.

The development of the Lachine section for power was a difficult hydraulic problem, for the reason that there is a long stretch of river flowing so fast that it stays open all the year, and is entirely on rock and would cost a fortune to enlarge to the point where an ice cover could be secured. Some amelioration might be secured by a scheme for splitting the river into two parts, which feature Mr. McLachlan went into at some length (page 64).

On the question being raised, Mr. McLachlan explained that the proposed work would not disturb the present Lachine canal, nor the Montreal aqueduct, nor the drainage of the country to any great extent. The cost of the power which could be developed in the Lachine section is greater than the cost in the Soulanges section and greater than that in the International rapids section, so there was no possibility, in his view, of power being required from the Lachine section for possibly 20 years or more. They, therefore, would not need to concern themselves at present with the Lachine problem to any greater extent than the present plans provided.

The engineers had been asked to determine certain hydraulic facts below Montreal. There was no question as to provision of necessary depth, but they were asked to determine the effect of the Chicago diversion on the long stretch of river between Montreal and the sea, and how it could be compensated for. By the compilation of a lot of information never previously available, they concluded that the diversion in question could be compensated for by dredging a certain depth, but when they came to examine Montreal Harbour, they found there was no way by which the harbour could be deepened without undermining the walls of the piers. However, they assumed that some day these piers would have to be rebuilt, and that when this was done compensation could be made for the loss of levels due to the Chicago diversion, and they estimated what the proportion of that cost would be. They also figured on compensation by other methods, such as those proposed for the mouth of the St. Clair river at lake Huron, which worked out to practically the same figures, namely, \$4,600,000.

Referring again to ice conditions, Mr. McLachlan stated that it was not generally appreciated that ice formed at the foot of lake St. Peter, below Montreal, fully a month before it formed at the outlet of lake Ontario. Lake Ontario stays warm until about the first of the year, whereas lake St. Peter commences to freeze by the first of December, or earlier. Another interesting fact was that water of the lake of Two Mountains, from the Ottawa river, reaches freezing point a week or so before it gets down to freezing at the foot of lake St. Peter, so that navigation at the entrance of the Lachine canal closes earlier than at any other part of the system, due to the fact that water from the Ottawa river flows into the Lachine canal. Ice conditions, in consequence, are a little more difficult to deal with as they go down the river, because the season is earlier and the ice forming period longer. The winter season at the outlet of lake Ontario and in the International section was really quite short.

Asked as to the probable time for completion of the works in the International section, Mr. McLachlan said that it would require about 8 years. To do the work down to and including Chrysler island would take 5 years, that was to say 5 years from Prescott to Chrysler island, and 3 years longer from Chrysler island to Cornwall.

DR. O. D. SKELTON ON INTERNATIONAL TREATIES AND AGREEMENTS

(Pages 69 to 96)

At the meeting of the Committee on May 9, Dr. O. D. Skelton, Under-Secretary of State for External Affairs, addressed the Committee on the subject of treaties and agreements which might have a bearing on the international aspect of the St. Lawrence project.

Dr. Skelton dealt with the international status of the river St. Lawrence and the present rights of Canada and the United States as to navigation on that river.

The first question was as to whether there is any general rule of international law, aside from the specific treaties and agreements, which would give the United States or any other country special rights or privileges in the St. Lawrence river. Dr. Skelton, as will be seen by reference to his statement in detail, stated that some authorities had drawn the conclusion from a survey of European treaties that it might be said to be an accepted rule of international law that all great international rivers are open to navigation either by the riparian states or by all states. The consensus of opinion of international jurists was, Dr. Skelton stated, distinctly against that interpretation. In other words, the prevailing view was that such rights of navigation on the rivers in Europe, Asia, Africa, and South America as exist are based not on any generally recognized principle of international law but on special treaties and agreements; that they are conventional and not matters of right.

Certainly, that was true as regards North America and particularly the St. Lawrence. Canada has never recognized the existence of any general rule of international law which would govern the navigation of the St. Lawrence. That had always been held to be a matter for specific arrangement with the United States or with any other power that might be interested. While the trend of development on other continents might have a certain bearing on the question, it did not definitely apply.

The treaty of 1783, ending the war of American Independence, provided that the boundary between the two countries should follow the 45th parallel until it struck the St. Lawrence and follow the middle of the St. Lawrence river to lake Ontario. This led to disputes as to the ownership of islands in the river, and, to avoid cutting across the middle islands, the Commissioners decided to assign every island completely to one country or the other. Following the war of 1812, the British Commissioners were very anxious that what was then called Grand Island, now Wolfe Island, immediately opposite the harbour of Kingston, and which had in the first instance been assigned to the United States, should, for strategic reasons, be transferred to Canada. It became necessary to transfer to the United States a number of islands in the river in return for the re-transfer to British allegiance of Grand or Wolfe Island, and this explains why the United States owns a prepondering number of the islands at the Long Sault.

In 1824 a lengthy controversy began as to whether the United States, as owning part of the territory on the Great Lakes, had the right of navigation down the river St. Lawrence to the sea. A very elaborate and very long exchange of correspondence ensued, and the building of railways which enabled the interior states to find an overland outlet for their goods to the sea considerably eased the situation.

Article 7 of the Ashburton-Webster treaty provided that the channels in the river St. Lawrence on both sides of the Long Sault island and of Barnhart

island, the channels in the river Detroit on both sides of Bois Blanc and the islands at the junction of the river and lake St. Clair should be equally free and open to the ships, vessels and boats of both parties.

The treaty of 1854, known as the Reciprocity Treaty, included a clause regarding the free navigation of the St. Lawrence river and canals, and also of lake Michigan. That treaty was permitted to lapse in 1866 at the instance of the United States, and the rights of navigation that had been accorded lapsed simultaneously.

The treaty of Washington, 1871, contained several clauses dealing with navigation rights. Article 26 of that treaty provided that the navigation of the river St. Lawrence, ascending and descending from the international boundary (Cornwall-St. Regis) to the sea, was forever to remain free and open for the purposes of commerce to the citizens of the United States.

Dr. Skelton was questioned as to whether these rights could be regarded as permanently equal rights, and replied that that had never been definitely and specifically mentioned, and in the Boundary Waters Treaty of 1909 there had never been any specific provision that each country should have free use of both sides of international waters. It had been understood though, and there was no real objection on that score.

The Treaty of Washington dealt also with the use of the canals, the British Government engaging to urge upon the government of the Dominion of Canada to secure for the citizens of the United States the use of the Welland, St. Lawrence, and other canals in the Dominion on terms of equality with the inhabitants of the Dominion. The government of the United States engaged, on the other hand, that British subjects should enjoy the use of the St. Clair Flats canal upon terms of equality with the inhabitants of the United States, and further engaged itself to urge upon the state governments to secure to British subjects the use of the several State canals connected with the navigation of the lakes or rivers traversed by or contiguous to the boundary line.

The navigation of lake Michigan also, for the term of years mentioned in Article 33 of that treaty, was to be free and open to British commerce. That provision lapsed and Canada had no technical right to the navigation of lake Michigan until the treaty of 1909.

As Canada, even after the treaty of 1854 had lapsed in 1866, did not interpose any objection to the continued use of the canals by the United States, it was not necessary for the British government to make any representations as provided in the treaty. As regards the other side of the question, the United States gave the free use of the Federal canals which it owned without question, but difficulty did occur in connection with the State canals, as a result of which Canadian vessels, while permitted to proceed through New York State canals to the Hudson river, were precluded from carrying goods in bond down the Hudson river to New York, as the Hudson river was claimed not to be a river contiguous to the border line. Far from trying to bar the United States from using our rivers and canals, Canada was anxious that they should use them in order to bring traffic to Montreal and to the river St. Lawrence. Some questions of difficulty arose as to the transshipment at American lake and river ports of Canadian grain destined to Montreal, as a result of which discriminating tolls were instituted, only eventually to be done away with entirely. (Pp. 75 to 76.)

THE QUESTION OF SOVEREIGNTY

Dr. Skelton was asked whether the American government would have the right in the St. Lawrence, in the international section, to improve navigation, or whether the right of sovereignty on the part of the Canadian government was paramount.

Dr. Skelton had never heard of any such suggestion or claim. In the international section, in the St. Clair and Detroit rivers, the United States had done a great deal of work, but always by consent of the Canadian government; this, in sections other than the St. Lawrence. Asked whether this was not an implied admission that the treaty did not affect the right of sovereignty of the Canadian government, Dr. Skelton replied in the affirmative. He thought there was never any question as to that, and it was the understanding of the Committee, in consequence, that the United States would have no right to do any work in the St. Lawrence from St. Regis to the sea.

Asked as to whether it was admitted or denied that either nation has the right to navigate the whole length of the river with war material or troops, Dr. Skelton replied that the point had never been formally settled.

Asked if there was any rule that it would be a violation of neutrality if Canada were at war with another country to traverse waters that are free to us, Dr. Skelton stated that it quite frequently was forbidden, but that there was a special provision in the case of the Suez canal and the Panama canal that they are open in war as in peace to vessels of war as well as commerce.

The point was raised as to the interpretation of the clause regarding the navigation of the St. Lawrence, ascending and descending to the sea, whether that covered canals or not. Sir John A. Macdonald had inserted an article in the Treaty of Washington which tended to show that it did not, but Dr. Skelton felt that it was, undoubtedly, still open to argument, though the question of interpretation of that point had never been discussed by any governmental agency, either in the United States or Canada. Any discussion had been by private parties.

DEVELOPMENT OF JOINT-INTERNATIONAL CONTROL

Dr. Skelton next dealt with the Boundary Waters Treaty of 1909, which set up the International Joint Commission, which was the outcome of a preliminary experiment on the joint inquiry into international boundary problems which had been conducted some years earlier in the establishment of the International Waterways Commission. The latter had been a body of very limited powers. It could only investigate and report. It had none of the quasi-judicial or administrative duties which, in certain respects, have been entrusted to its successor. The former body was empowered to investigate and report on questions dealing with

“waters adjacent to the boundary between Canada and the United States including all the waters finding their way by the river St. Lawrence to the sea”.

The scope of their duties was quite wide geographically, though their powers were limited merely to investigation and report.

One thing the old International Waterways Commission did was to lay down certain conditions of priority in the use of boundary waters; domestic and sanitary uses coming first, navigation next, and power and irrigation third. Another thing they did was to recommend to both Governments that they should set up a permanent body for the settlement of all boundary water questions. That was agreed to and a treaty was eventually ratified which provided not merely for the establishment of the permanent body—the International Joint Commission—of to-day, but referred to it certain boundary water problems, and also made it possible to refer to the Commission certain broader questions in dispute between the two countries. This was provided for by the treaty of 1909, which was ratified in the following year.

Dr. Skelton took up the various articles of the treaty of 1909 in their order and explained their application as he conceived it.

Asked which of the provisions of the treaty were permanent and which temporary, Dr. Skelton replied that there were none that could be specifically said to be temporary, that all were supposed to be permanent. The treaty itself was one that could be denounced at the end of five years, but it was not temporary.

The preliminary article of the treaty states that:—

“For the purposes of this treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers and waterways, or waterways flowing from such lakes, rivers, and waterways, or the waters of rivers flowing across the boundary.”

Dr. Skelton was asked whether consent of the International Joint Commission would have to be obtained for a development such as the Cedar Rapids power development in the purely national section of the river. Dr. Skelton replied that during the tenure of office of the former International Waterways Commission the application of the Cedar Rapids Manufacturing and Power Company to the Dominion Government to build works in the St. Lawrence at Cedars was granted, subject to the consent of the Public Works Department as to navigation requirements. The Department of Public Works requested the International Waterways Commission to report on the matter, which Commission did so, and reported that it did not see any objection to the proposed development, and, with certain restrictions, the Department of Public Works recommended the granting of a charter to the Cedar Rapids Company. Had the application been made subsequent to the treaty of 1909, it would not have been necessary to refer it to the International Joint Commission.

Article 1 of the treaty provides,

“That the navigation of all navigable boundary waters shall forever contain free and open for the purposes of commerce to the inhabitants and to ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation, and applying equally and without discrimination to the inhabitants, ships, vessels, and boats of both countries.”

Asked whether that carried any further than the previous treaties had carried, Dr. Skelton replied that it specifically granted the right, not previously enjoyed, whereby both countries could use the water on the opposite side of any boundary river. Prior to that treaty, it might have been alleged that Canada had no right to use or traverse the United States side of boundary rivers.

The second paragraph of article 1 reads:—

“It is further agreed that so long as this treaty shall remain in force, this same right of navigation shall extend to the waters of lake Michigan and to all canals connecting boundary waters, and now existing or which may hereafter be constructed on either side of the line. Either of the High Contracting Parties may adopt rules and regulations governing the use of such canals within its own territory, and may charge tolls for the use thereof, but all such rules and regulations and all tolls charged shall apply alike to the subjects or citizens of the High Contracting Parties, and the ships, vessels and boats of both of the High Contracting Parties, and they shall be placed on terms of equality in the use thereof.”

In connection with this paragraph, it developed from discussion that, on strict interpretation, it accorded rights to the contracting parties only in canals connecting boundary waters such as the Sault canals and the Welland canal. It did not apply to any lateral canals lying wholly within Canada which did not connect boundary waters.

Article 2 of the treaty provides that each country reserves to itself the control of rivers on its own side flowing into boundary waters. Article 3 Dr. Skelton considered the most important article in the treaty. It provides as follows:—

“It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the Parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions, and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

“The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbours, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes”.

The foregoing is the most important article in the treaty so far as its connection with the International Joint Commission is concerned. A later article—article 7—agrees to the formation of an International Joint Commission, consisting of three members from each country, and article 8 gives the International Joint Commission jurisdiction to pass upon the cases mentioned in article 3 and the following article—article 4—which, except in cases provided for by special agreement, prohibits

“The construction or maintenance on either side of the boundary of any remedial or protective works or dams or any other construction in waters flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary unless the construction or maintenance thereof is approved by the International Joint Commission.

At the request of an honourable member, Dr. Skelton went into the history of the Massena weir application of the St. Lawrence River Power Company which, in 1917, applied to the United States government for permission to do certain dredging and to be allowed to construct a submerged weir from the main shore of the United States to Long Sault, also in United States territory. The Secretary of War gave the necessary permit, subject to the approval of the International Joint Commission. At the hearings of the latter body the representatives of the Canadian government raised strong objection to the application, quoting the Ashburton-Webster Treaty of 1842, wherein it was agreed that the channels on both sides of the Long Sault and Barnhart Islands should be equally free and open to ships, vessels, and boats of both parties. For the United States it was contended that “equally free and open” simply meant that there was to be no

discrimination, and if it was closed against United States vessels as well as against Canadian vessels, and if the other channels were open for navigation, and if, as a matter of fact, the south channel in question was not used for navigation except by pleasure boats, there was no violation of the treaty. The International Joint Commission took the view that they should not settle the question definitely at that time, and gave a temporary and interim ruling permitting the company to construct the weir on the understanding that the order was to remain in force for five years or until the end of the war, whichever period should be the longer, and then come up for review. The chief consideration at that time, 1917, was the fact that the St. Lawrence Power Company, a subsidiary of the Aluminum Corporation, was producing much of the aluminum required by the allies in the prosecution of the war.

When the matter came up for review in 1922, the Canadian government insisted on maintaining all the objections previously raised in 1918, though subject to certain conditions, they would not object to a temporary extension of the permit. These conditions included provisions to make sure that no more water would be diverted than was being diverted, and guarantees against injury to Canadian navigation interests in the river.

About three months ago, the St. Lawrence River Power Company brought another application before the International Joint Commission to have the submerged weir made permanent and raised above the surface six feet. The Canadian government asked for a postponement to enable it to file a statement in response. The International Joint Commission, at a meeting in Washington in April, was prepared to grant an extension accordingly, but the representatives of the company took the ground that if they were not able to go ahead with the work at once they might find it advisable perhaps not to go ahead at all this year, and they agreed to adjourn sine die.

In response to a question, it was stated that the diversion by the St. Lawrence River Power Company amounted to 25,000 second feet.

Proceeding, Dr. Skelton dealt with article 5 of the treaty which had to do with the division of water for power purposes at Niagara. In that connection, the question of the Chicago diversion had been raised in Committee, and whether Canada had not committed itself to accepting a diversion of 10,000 cubic second feet at Chicago in return for the margin it had received in the unequal division at Niagara, where the United States is allowed to draw off for power purposes 20,000 cubic second feet, and Canada 36,000 cubic second feet.

The position had been taken that Canada committed itself to accept this division, the former International Waterways Commission, having stated:

"In addition to the other reasons for a greater share going to Canada, we may mention the fact that there is at present—as an actual fact—10,000 cubic second feet diversion at Chicago."

Personally, Dr. Skelton did not think there was any ground for the contention that, in article 5 of the Boundary Waters Treaty, Canada had committed itself in regard to the Chicago diversion in any shape or form. The article then proceeded to authorize the 20,000 and 36,000 distribution already referred to. In discussing the reason for the unequal division at Niagara, Dr. Skelton explained that the average flow of Niagara Falls was about 220,000 cubic second feet, and the former Waterways Commission, which was a joint body representing both countries, had concluded that no more than one-quarter, or 55,000 cubic second feet, of that flow could be developed without injury to the scenic beauty of the falls. At that time, there were already on the Canadian side plants in construction, which would require about 32,000 or 33,000 cubic second feet. On the United States side the plants under construction would not require more than half that amount. There was the added reason that a considerable quantity of the

power generated on the Canadian side was for United States consumption. The question of the actual flow over the respective American and Canadian portion of the falls did not appear to be a factor, and it was clear that the diversion at Chicago was wholly unauthorized so far as Canada was concerned, and that the Canadian government has not at any time consented to it.

It developed incidentally that the treaty apparently legalized diversions existing at the time of the ratification of the treaty. At that time the actual diversion at Chicago was 4,167 cubic second feet, which was the quantity authorized by the formal permit of the United States Secretary of War, and to that dimension the diversion must be reduced by 1935, under arrangements which the United States Federal authorities are seeking to impose upon the Chicago sanitary district.

MR. McLACHLAN ON THE ECONOMICS OF THE WATERWAY

(Pages 96 to 121)

On May 9, Mr. McLachlan was recalled for a discussion on the economics of the proposed deep waterway. In that connection he referred to the various routes that are available for a deep waterway from the Great Lakes to the ocean. The United States have been considering a project from lake Ontario via Albany to New York, and a report had been made by the War Department on it. That was the only serious rival the St. Lawrence project had.

The State of New York had, between 1905 and 1918, enlarged the State canal between Buffalo and the Hudson river at a cost of \$175,000,000. The canal is 75 feet wide and is supposed to be 12 feet deep, and is crossed by hundreds of bridges with only 15 feet headroom. Between Buffalo and New York there are 170 miles of canal with 35 locks, and 179 miles of river channel less than 200 feet wide, 100 miles of open river, and 27 miles of lake navigation. The canal costs the State of New York about \$10,000,000 per year, and the total benefits are supposed to be \$1,500,000. Its failure is said to be due to the low headroom provided at bridges and the great length of narrow canal.

Mr. McLachlan thought it might be assumed that the United States would use Canadian canal facilities between lake Erie and Lake Ontario. In that case, the United States project would probably be that of building a new canal from Oswego roughly following the barge canal to Albany and down the Hudson river to New York. The estimated cost for 25 feet depth would be \$506,000,000.

The United States government, in co-operation with the port of Albany, are now developing an ocean terminal at Albany, and are deepening the Hudson river to that point to 27 feet. That port is expected to be a rival of Montreal in the near future, and will have a navigation season one month longer than the Canadian port. The United States engineers had not only estimated the cost of the Oswego-Albany project but had contrasted the economics of the project with the St. Lawrence. Action, however, has been held up, pending negotiations with Canada on the St. Lawrence proposals. The United States project might develop a larger traffic than the St. Lawrence, and, if operated free of tolls, might give slightly cheaper transportation, because rates out of New York are lower than those out of Montreal. Mr. McLachlan had made an investigation of the United States route several years ago, which indicated that it would pay interest on its cost. In his opinion, it would be a very much better paying proposition than the Georgian Bay canal project, and was the closest competitor of the St. Lawrence plan.

Mr. McLachlan submitted statements (pages 98 and 99) showing the annual charges and benefits which might be expected from the St. Lawrence development. With the Chrysler island project in the International Rapids

section, and the Hungry bay-Melocheville project in the Soulanges section, and assuming that the upper lake channels will be improved for upper lake navigation free of charge against the St. Lawrence project, Mr. McLachlan estimated a first cost of \$360,534,000, interest during construction \$81,689,000, a total over all cost of \$442,223,000. On this sum, the annual interest charges, operating and maintenance and depreciation were estimated at \$26,653,000, and the annual benefits at \$67,950,000. Of this latter sum, \$30,750,000 was from power. \$15,000,000 savings in transportation costs on Canadian traffic, and \$22,200,000 savings on transportation costs on United States traffic.

The foregoing estimate did not take into account the Welland Ship canal, the cost of which is estimated at \$115,000,000, and the annual charges—interest on first cost, interest on interest during construction, and operation and maintenance—amounted to \$7,400,000, while the saving in transportation costs on the Welland Ship canal, standing alone, was estimated to be \$1,000,000 per annum.

Mr. McLachlan submitted another statement, (page 99) showing the estimated annual charges and benefits from navigation works only. On the St. Lawrence work, on the scheme discussed above, the first cost was set at \$123,070,000, interest during construction at \$13,990,000, a total of \$137,060,000. The carrying charges on this over all cost, including interest, operation, maintenance and depreciation, were set at \$8,404,000, and the annual benefits—saving on transportation costs as already given—\$37,200,000. In this set up, the figures respecting the Welland Ship canal, as rendered in a previous paragraph, are unchanged.

Mr. McLachlan explained that the first statement was based on the idea of taking the power in the international rapids section as part of the project and avoiding contact with power developments in the national section.

The second statement was based on the idea that navigation would follow power development and be charged only with works built for navigation purposes. It was based on the idea that some power interest would pay for common and power works. These would embrace the necessary dam and the general enlargement of the river, the construction of the power houses and the machinery for both countries on both sides of the river. That conception arose from his reading of the decisions of the Supreme Court and the Privy Council in connection with a number of water power cases which had been tried in Canada and elsewhere, and also from the way in which the power had been leased on the Trent system where the government made improvements. Navigation was like the King's highway; the local authorities must provide the land required without tax. Where riparian rights were in private hands, the King would have the right to put in locks for passing from one basin to the other. On the conception that, if the river were improved for power, certain expenditures would have to be made, (and that those would logically include dams and channel enlargements as well as power works), the additional cost of preparing the river for navigation would be the cost of putting in the canals for passing dams, along with lift bridges, etc.

Mr. McLachlan dealt with the very rapid development of the use of power during the last decade. In the United States that rate of increase amounted to about 8% per year, or 1,500,000 h.p. Some people wondered how long this increase would be maintained, but, in Mr. McLachlan's opinion, power development was still an infant industry. In 1923, the total kilowatt hour generation in Canada was 20,000,000. In 1927, it was 40,000,000. For Ontario and Quebec alone, the development had increased from 17,000,000 kilowatt hours in 1923 to 34,000,000 in 1927. It would take an extra installation of 350,000 h.p. each year to supply the demand in Ontario and Quebec in recent years. The market for electric power was increasing at the present time to the extent of 75,000 h.p. per year in Quebec, and 75,000 h.p. in Ontario. It could come from the St. Lawrence as well or better than any other place.

The value of the horse power developed under the proposal discussed was set by Mr. McLachlan at \$15 per h.p. for firm power capable of being delivered at peak hours of each day throughout the year, and at half that sum for the summer power which could not be delivered in winter. In the matter of traffic, tonnage passing the Sault canals in 1926 was about 85,000,000 tons, consisting of ore, coal, grain, package freight, etc. The Welland canal last year had a traffic of 7,250,000 tons, and the St. Lawrence 7,900,000 tons. That the St. Lawrence had a larger traffic than the Welland canal was due to coal moving from lake Ontario ports to Ogdensburg and Montreal, and due also to pulp-wood moving from the lower St. Lawrence to Waddington and Ogdensburg.

Grain shipped on the Great Lakes for the fiscal year 1926 amounted to 430,000,000 bushels. Of that amount 295,000,000 bushels left Fort William and Port Arthur, 25,000,000 left Duluth, 50,000,000 left Chicago, and 9,000,000 left Milwaukee. In that year 93,000,000 bushels went through the government elevator at the head of the Welland canal at Port Colborne, and 135,000,000 bushels went through Montreal.

In 1926, Canadian exports of grain amounted to 349,000,000 bushels and the United States exports to 274,000,000. Much of this latter business is not tributary to the Great Lakes waterway and goes out by the Gulf of Mexico and Pacific ports, including Vancouver. Exports from Montreal, Quebec, Halifax, St. John, and United States north Atlantic ports, including Baltimore, totalled 298,000,000, of which Canadian ports handled 209,000,000 and American ports 89,000,000 in 1926. In the seven months of open navigation, the amount that left Canadian north Atlantic ports was 131,000,000 bushels, and from United States north Atlantic ports 68,000,000. These comparative figures spoke well for the port of Montreal. In 1926, 48,000,000 bushels of Canadian grain went out via United States Atlantic ports and 131,000,000 by Canadian Atlantic ports. In that same year, 27,000,000 of United States grain went out by United States Atlantic ports and 60,000,000 by Canadian Atlantic ports. Canadian exports and the production of wheat, flour, and grain had been continuously increasing, while the exports of United States grain had been diminishing, though flour had been increasing. It seemed strange that out of the total export of the equivalent of 347,000,000 bushels of wheat, amounting to 9,000,000 tons, it was possible to figure on only 4,450,000 tons as available for the St. Lawrence deep waterway. Perhaps that figure was too conservative, but, at any rate, it was safe.

The rate per bushel for the last five years from Fort William to Buffalo was 3.5 cents, from Port Colborne to Montreal it was 6.05 cents. In those rates 0.7 cent was absorbed for terminal elevator charges in the movement from Fort William to Port Colborne and 1.44 cents in the movement from Port Colborne to Montreal.

Mr. McLachlan dealt with the question of rates and the effect of retardation by canal works on the cost of the movement. They could compare the time it would take a boat to travel the length of the new route with the time it took on the superseded route, and, in that way, determine what the cost of transportation by the future route would likely be. Determined on the basis of time, it was found that the cost of actual movement per mile across a lake surface by a Great Lakes boat would work out at 8 cents for every ton hauled 100 miles and at about 24 cents a ton for terminal delays occasioned to the boat. Applying the same formula to the canal boat, a rate of 16 cents was obtained for the clear parts of the journey. Naturally, the retardation of the Welland canal locks and the restricted channels on the Welland, along with the retardation of the St. Lawrence locks, and the restricted canal channels along the St.

Lawrence has virtually doubled the distance between Port Colborne and Montreal. A boat could travel twice the actual distance between Port Colborne and Montreal in the same time if the journey were by lake.

The 8 cent rate referred to in the foregoing paragraph was declared by Mr. McLachlan to be an interesting figure because, if ocean rates from ports all over the world were analyzed, it would be found that 8 cents per 100-ton mile practically the rate on every grain route throughout the world, whether from Australia, the Argentine, Karachi, or Vancouver, to the world market at Liverpool.

Mr. McLachlan went into the capital costs of vessels suitable to the combined lake and ocean trade. From these figures, and the costs of operation, including time of travel, it was calculated that the cost of transportation of a ton of freight from Fort William to Liverpool by the present route was \$5.87 a ton, and by the proposed deep waterway it would be \$3.95. Thus, if there were no intervening transfer between Fort William and Liverpool, the saving would be \$1.92 a ton. Those figures included a profit to the ship owner, as well as interest, depreciation, etc., for which 14 per cent is usually allowed.

Included in the \$15,000,000 of benefits estimated as being applicable to Canadian traffic were 450,000 tons of flour, 800,000 tons of British Columbia timber, via the Panama, 800,000 tons of Scotch and Welsh anthracite, other commodities, 2,000,000 tons; a total, including the grain traffic previously discussed, of 8,000,000 tons. The tons referred to in this calculation are long tons—38 bushels of wheat and 2,240 pounds to the ton. The saving on grain was estimated at \$1.50 a ton; on flour, a total of \$1,600,000; on coal, \$2,000,000; on other commodities, \$3,000,000; making the total of \$15,000,000 already mentioned.

The estimating of American traffic was a very complicated matter, but United States investigators determined it to be about 16,400,000 tons, and the consequent saving at \$1.35 per ton, a total of \$22,200,000. Mr. McLachlan thought their traffic would likely be less than that, but he did not think their saving per ton would be less than the sum indicated.

Referring again to the figure of \$26,000,000 for annual charges and \$68,000,000 for annual benefits, which presumed the development of the international section by a federal agency, Mr. McLachlan pointed out that there were other things which should be absorbed in the cost of the project. For instance, the present canal carrier, the 2,400 ton boat—and there are about 100 of them—would, no doubt, have a very restricted usefulness after the waterway was built, because all they could be used for would be for pulp wood and coal between lake Ontario and Montreal. Therefore, part of the interest on their value should, he thought, be deducted from estimated benefits or included in the item of cost. Similarly, the elevators of Port McNicoll, Goderich, Port Colborne, and Midland, would all suffer a reduction in value, which ought possibly to be absorbed in the cost of the project.

Mr. McLachlan filed a memorandum indicating that a 10 per cent increase in traffic could take place on the St. Lawrence canals without serious congestion. Their capacity from Prescott to Cornwall is very nearly reached in the months of October and May. The completion of the Welland Ship canal, and establishment of a terminal at Prescott, would tend to congest the canals for the reason that the length of the voyage from Port Colborne to Montreal would be reduced from about $6\frac{1}{2}$ to 3 days, or with terminal delays from $9\frac{1}{2}$ to 6 days. So that, if the 100 boats on the route were all busy and taxed the canal to within 10 per cent of its capacity, there would be sure to be congestion with the voyage for 84 per cent of the downbound business reduced from $9\frac{1}{2}$ to 6 days per trip. An increase of 75 per cent in lockage capacity would be required

to keep the canal fleet busy after the point of transfer is shifted to Prescott. The locks at Cornwall were the point of difficulty. There, the capacity might be taken as 9,000,000 tons; whereas the capacity of the Soulanges and Lachine canal might be taken as 14,000,000 tons. Unless the two locks at Cornwall could be duplicated, they would not have sufficient capacity to care for more than a 15 per cent increase in traffic. The cost of two additional locks was estimated at about \$1,000,000.

Mr. McLachlan filed with the committee the complete statement on the value of the St. Lawrence waterway as a transportation route to which he had referred in part in his evidence, of which the foregoing is a summary. Mr. McLachlan's remarks on the economic aspects of the proposals will be found set out in committee proceedings (pages 98 to 121).

The statements referred to by Mr. McLachlan formed part of an economic study of the project prepared by him and G. A. Lindsay, senior office engineer, of the St. Lawrence waterway staff of the Department of Railways and Canals, Ottawa. It will be found printed in full at the end of the committee proceedings. A digest, or statement of contents, which appears with the study as printed, is reproduced at this point as a guide to the reader, as is also an index to the various statistical tables forming part of the economic presentation:—

PART "A"—VALUE TO CANADA

	PARA.
Comparison of the proposed St. Lawrence Waterway with existing waterways.....	4
The proposed St. Lawrence Waterway.....	5
The Welland Ship Canal.....	6
The Manchester Ship Canal.....	7
The Amsterdam Canal.....	8
The Suez Canal.....	9
The Parana River.....	10
The Panama Canal.....	11
Other Routes.....	12
Effects of Locks.....	14
Transportation Costs.....	17
Ship Costs.....	18
Cost of Transporting Grain.....	20
Transporting Package Freight.....	22
Summary.....	28
Volume of Canadian Traffic and Annual Savings in Transportation Costs.....	30
Grain.....	32
Exports to China and Japan.....	37
Flour.....	48
Lumber.....	50
Coal.....	53
Other Commodities.....	55
Summary.....	57
Draught.....	59
Return Cargoes.....	67

PART "B"—VALUE TO THE UNITED STATES

Estimate of Potential Traffic.....	73
Transportation Costs on Grain.....	75
Lumber.....	78
Iron Ore.....	81
Package Freight.....	85
Summary.....	87

PART "C"—ANNUAL CHARGES AND BENEFITS FROM ST. LAWRENCE WATERWAY PROJECT

Summary.....	90
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TABLES

	PAGE
Table 1 Length of various routes in statute miles.....	314
" 2 Characteristics and performance of ships.....	314
" 3 Summary showing time of navigation of waterways in days.....	315
" 4 Statement showing time of navigation of waterways.....	315
" 5 Cost of elevator operation transferring 33,000,000 bushels per year from one ship to another.....	317
" 6 Insurance and pilotage rates—various ships.....	318
" 7-13. Cost of transportation of grain—various routes.....	318-321
" 14 Cost of transferring package freight from car to ship at Montreal.....	322
" 15 Cost of transferring bagged commodities from canal boat to vessel at Montreal..	322
" 16 Cost of transferring bagged commodities from rail to ship or ship to rail at Fort William or Port McNicoll.....	322
" 17 Tonnage through Canadian and American canals at Sault Ste. Marie.....	322
" 18 Traffic through Welland Canal.....	323
" 19 Traffic on St. Lawrence Canals.....	323
" 20 Lake and rail shipments of wheat, wheat flour, and other grain from head of Lakes.....	323
" 21 Canadian wheat and other grain from head of lakes passing through Sault Ste. Marie canals by points of destination.....	324
" 22 Canadian flour from head of Lakes passing through Sault Ste. Marie canals by points of destination.....	324
" 23 Exports of Canadian grain and wheat flour from U.S. north Atlantic ports, Montreal and Quebec, in 5 and 7 months periods.....	325
" 23a Exports of American grain from U.S. North Atlantic ports, Montreal and Quebec, in five and seven months periods.....	326
" 24 Exports of Canadian wheat and other grains overseas by routes.....	327
" 25 Exports of Canadian wheat, wheat flour, and other grains by countries and destinations.....	328
" 26 Production and export of wheat from Canada and United States.....	328
" 27 Average production of wheat per capita and exports of wheat and wheat flour per capita of the United States for ten year periods from 1870 to date.....	329
" 28 Average production of wheat per capita and average exports of wheat and wheat flour of Canada per ten year periods from 1871 to date.....	329
" 29 Average production and exports per capita of grain other than wheat of Canada for ten year periods from 1871 to date.....	329
" 30 Traffic through Manchester, Suez, and Panama Canals.....	329
" 31-35. Cost of transportation of grain from Edmonton to Liverpool by various routes.....	330-331
" 36 Dimensions of standard cargo ships as determined from averages of those listed in recent years.....	331
" 37 Estimated carrying capacity of ships built in 12 leading countries of the world and still afloat in 1913-1923 and 1924.....	332
" 38 Potential study of U.S. exports.....	333
" 39 Potential study of U.S. Imports.....	333
" 40 Annual shipments of grain on the Great Lakes.....	333
" 41 Annual shipments of grain on the Great Lakes, by ports.....	334
" 42 Annual shipments of grain on the Great Lakes, by kinds.....	334
" 43A Grain receipts at Montreal, 1923.....	334
B Grain receipts at Montreal, 1924.....	335
C Grain receipts at Montreal, 1925.....	335
D Grain receipts at Montreal, 1926.....	335
" 44 Grain and flour exports from Canada and United States, 1908-1926.....	336
" 45 Monthly movement of iron ore on the Great Lakes.....	336
" 46 Monthly movement of soft coal on the Great Lakes.....	336
" 47 Comparison of freight handled by Canadian Steam Railways with freight handled on St. Lawrence Canals.....	337
" 48 Annual charges and benefits from Deep Waterway Project.....	337
" 49 Annual charges and benefits from Navigation Works only.....	338

A. L. W. MacCALLUM, SHIPPING FEDERATION OF CANADA

(Pages 122 to 128)

Mr. A. L. W. MacCallum, Manager and Secretary of the Shipping Federation of Canada, Montreal, appeared and testified. He explained that the Shipping Federation of Canada was incorporated in 1903, and was a Canadian association of steamship owners and agents interested in the ocean shipping trade to the St. Lawrence and to eastern Canadian seaports. Its membership did not include inland vessel owners or operators. The total tonnage represented was 1,961,633 gross tons.

The aims and objects of the Federation are to safeguard the interests of its members in connection with aids to navigation, channel and harbour depths, harbour facilities, pilotage, towage, port charges, etc.

Since the publication of the report of the Joint Board of Engineers in November, 1926, it had given careful study to the St. Lawrence question and had investigated particularly the possible economic benefits which would accrue to Canada as a result of ocean vessels proceeding beyond Montreal to the Great Lakes. Its attitude towards the proposed waterway was not actuated by any spirit of factious opposition to further St. Lawrence improvement, nor was it based on the interests of any particular or local port. The immense expenditure involved in the proposed undertaking could only be justified by commensurate benefits to the country. During 1926, 96 per cent of the Canadian through traffic eastbound through St. Lawrence canals consisted of grain, so that the proposed expenditure could only be justified by commensurate reduction in the cost of grain transportation. Extravagant claims, principally American, had been made as to the possible saving—claims varying from 6 cents to 10 cents per bushel. The Federation had given special consideration to the possibility of ocean vessels proceeding beyond Montreal to Great Lake ports, and in their opinion the only ocean going vessels that would use the proposed waterway were the transient, or tramp vessels, carrying bulk cargoes, and only a proportion of these could, when fully loaded, utilize the 27 foot channel between Montreal and lake Ontario. Cargo space is a commodity equally with grain itself, and rates for its use are governed by the law of supply and demand. To meet the extra expense and risks involved in proceeding beyond Quebec and Montreal proportionately higher rates would have to be charged. Calculations based only on distance and time of travel would indicate a maximum saving as compared with existing all-water rates on the St. Lawrence of 2 cents to 3 cents per bushel, but the seasonal character of the traffic, the very short period during which grain could be moved by ocean vessels direct from the head of the Lakes, and the dependence of tramp rates and the supply of tramp vessels on world wide traffic conditions would necessarily be reflected in the actual rates. The absurdity of exorbitant claims of savings, as high as 10 cents per bushel, is evident from the fact that in order to affect such a saving the tramp vessel would have to travel 1,200 miles beyond Montreal and 1,200 miles back to Montreal and charge 2 cents per bushel less for the carriage of her cargo from the head of the Lakes to Liverpool than this class of vessel charged for the carriage of a similar cargo from Montreal to Liverpool during the past season of St. Lawrence navigation.

Apart from the fact that the probable benefit to the grain growers of the Canadian Northwest as the result of building the proposed waterway would be negligible when compared with the cost of construction, there were other factors materially affecting the situation, namely:—

- (a) Further possible reductions in the present cost of carriage via the existing St. Lawrence route due to Welland enlargement.

- (b) Reduction of freight rates by rail to the Canadian seaboard.
- (c) Shipment of Alberta and Saskatchewan grain through Pacific Coast ports.
- (d) The development of the Hudson Bay route.

If the project were viewed from the standpoint of benefits to import traffic, Canada's situation would be found to be fundamentally different from that of the United States. Every portion of the Dominion, except the Prairie Provinces, already enjoyed water transport facilities and the situation of the Canadian Northwest had been greatly improved by the development of Pacific Coast outlets, and it is expected to be further improved by the Hudson Bay project. Notwithstanding Canada's favourable position for imports by water from trans-oceanic countries, about 65 per cent of our total imports come from the United States and in this connection no benefit would accrue to Canada from the deepening of the St. Lawrence.

American traffic available for the deeper waterway is also available for the present waterway—the cheapest of all means of transportation between the Middle Western States and the Atlantic seaboard. It is surprising, therefore, that this route has not been utilized to a greater extent by American territories tributary to the Great Lakes, though American vessels may make use of the entire system free of canal tolls.

It was the conviction of the Association that the project is untimely and premature. Over-investment in water transportation was certainly not justified by a similar experience in the matter of railways. The Association is unalterably opposed to any international control of Canada's outlet to the Atlantic. It believes the present national waterway policy should be continued by Canada, and that the present St. Lawrence system can be utilized to greater capacity and improved at moderate cost as, and when, required by Canada's economic development and warranted by her financial position.

MR. THOMAS HARLING, PRESIDENT THOS. HARLING & SON, LTD.

(Pages 128 to 137)

Mr. Thomas Harling, President, Thomas Harling and Son, Limited, Steamship Agents, Montreal, while largely confirming the opinion expressed by Mr. MacCallum did not think the question of tramp steamers had been fully explained. After sketching historically the development of the harbour of Montreal, with which he personally had much to do, he stated that there was now a storage capacity there of about 12,500,000 bushels, and they could handle 1,000,000 bushels in and out per day, provided the stream were kept continuous both ways. Last year they handled 195,000,000 bushels of grain without the slightest congestion. The inland carriers obtained a quick turn round for their boats and the ocean carriers also obtained a despatch equal to, if not better than, that obtainable in any other port in the world. He believed the business of the port to be capable of still further development, but increased facilities were required to develop traffic. The berths at the west end of the harbour had been changed so as to provide grain loading accommodation for tramp steamers without interfering with regular lines which were taken care of almost entirely by the centre elevator in the harbour. The tramp steamers have at the east end, an elevator of 3,000,000 bushels capacity, being increased to 6,000,000 bushels, so as not to interfere with the regular lines. The success of Montreal as a grain port was largely owing to the absolute control of every berth by the Harbour Commissioners. Only 19 per cent of the grain handled

by the port of Montreal came through by rail, the balance coming down by water. This, he felt, proved that Montreal's advantage as a grain port lay in the cheap transportation of grain from the head of the lakes across the Atlantic.

The inland service was very good. There are about 120 canal-sized steamers, the largest boats and the largest number of boats carrying grain on the Great Lakes being American owned, but the grain brought down to Port Colborne and Buffalo was there transferred to the canal-sized steamers which brought it to Montreal. The maximum cargo of this type of steamer is about 95,000 bushels. If it had not been that the inland lake tonnage had been increased, by competition very largely, they would not have as low rates as were now enjoyed from the head of the lakes to Montreal. Lake vessels carry more deadweight cargo because ocean vessels are limited by the draft to the Plimsoll mark; lake boats not having to observe that regulation carry larger cargoes. If the canal were deepened the large upper lake boats could go through to Montreal and that, he considered, would be an advantage because they would make a direct connection with the ocean steamers and save an intermediate transfer. Ocean steamers operated at considerably less per ton than the inland carriers on account of their working for 365 days a year, whereas the inland carriers operated for only about 220. The ordinary present sized St. Lawrence canal boat costs about \$150,000 and had a capacity of about 2,000 tons.

The question as to whether these vessels would be thrown out of commission would depend on whether a vessel could be designed of a more economic type to carry the grain between Prescott and Montreal. He believed it could. In fact he was satisfied that barges could be provided instead of steamers, with their own propelling power. Vessels now employed could either tow a barge with them, or a Diesel motor could be used. This would reduce the number of men to probably half of the present requirement and the cost of handling grain from the Lower Lake-St. Lawrence terminal to Montreal would be very small compared with the present cost of 6 cents from Buffalo and Port Colborne to Montreal. The rate from the head of the lakes to Montreal is about 9 cents per bushel, and if the larger steamers could come down as far as Kingston or Prescott he believed grain could be handled to Montreal for 1 cent or $1\frac{1}{2}$ cents per bushel. On that haul he did not think the barge could be beaten by the railway—even the most economic railway that could be constructed—in which connection the cost of transfer would require to be considered. Barges would be useful for winter storage at a very economic figure, and with that additional equipment he did not think that Montreal could ever be beaten by any Atlantic port. He acquiesced in the suggestion by an honourable member that the large steamer could carry to Prescott for 4 cents, and if the movement from that point to Montreal cost 2 cents that would be 6 cents as against 9 cents, the rate commonly charged to-day. What they needed in Montreal was increased facilities. Conditions were so bad at present that they were obliged to send a great many vessels away.

He saw no practical difficulty in navigating the largest lake vessel to Montreal if the necessary facilities are provided. Years ago, it was complained in Liverpool that steamers would never go through the canal to Manchester. As a matter of fact, the Manchester Ship canal to-day is an undoubted success.

In the short season of navigation the brief voyages are the more important, and more economical for a vessel, but in the summer season when things are slack, the longer the voyage the better. In the spring and fall, when the demand is greatest, quick despatch is the more important. It required three days to navigate from Port Colborne to Montreal, and three and a half or four days to return, in which time a big cargo boat turning at Port Colborne or Buffalo could be at Fort William and back. He thought the barge system for the St.

Lawrence would be the most economical in the end, and if Montreal is to take care of this business there must be increased facilities. They thought Montreal was doing a big business with about 1,000 or 1,200 steamers a year. If the St. Lawrence were deepened the amount of cargo available from the immense area of the United States and Canada would make present business but a flea bite as compared with the amount of traffic that would eventually develop. An honourable member pointed out that the 20,000,000 tons put through the Panama canal is only one-quarter or one-fifth of what goes through the canals at Sault Ste. Marie. In his time the Great Lakes tonnage had increased from 40,000,000 to nearly 100,000,000 tons per annum. Out of that 100,000,000 tons about 65 per cent is ore, 25 per cent coal, and about 10 per cent grain. If that business is 100,000,000 tons to-day what, he asked, would it be if they had a through canal open to the ships of the world?

THOS. W. HARVIE, GENERAL MANAGER AND SECRETARY,
MONTREAL HARBOUR COMMISSIONERS

(Pages 138 to 155)

Thomas W. Harvie, General Manager and Secretary of the Board of Harbour Commissioners, Montreal, appeared before the committee on Tuesday, May 29. Before hearing Mr. Harvie, Senator McDougald, as chairman of the Harbour Board and a member of the Canadian National Advisory Committee on St. Lawrence matters, expressed his regret that he had not been present when Mr. A. L. W. MacCallum, manager and secretary of the Shipping Federation of Canada, appeared before the committee. He would have been quite satisfied with the testimony offered by the Shipping Federation of Canada had the Federation confined itself to its proper function, which was the safeguarding of ocean navigation, and which function largely ended at Montreal. Senator McDougald quoted Colonel Gear, vice-president of the Shipping Federation, as having publicly stated in October, 1927, that he was not opposed to the deepening of the waterways, but in favour of it on condition that the work be done by Canada when the country could afford it.

Senator McDougald claimed that the port and harbour of Montreal was more vitally interested in the scheme than any other institution or part of Canada. He was not alone amongst those in Montreal concerned in the affairs of that port and harbour who have supported the project for deepening the waterways and canal system, and he read into the record (pages 165-6-7) a statement presented to the International Joint Commission in 1920 when that body was dealing with the reference to it at that time of the proposed deep-water development of the St. Lawrence. President Ross made it clear at that time that the Montreal Harbour Commissioners were of opinion that it was desirable to improve the present St. Lawrence canal system to facilitate access of the larger lake boats to the port of Montreal. They were of opinion also that the type of vessel suited to lake service was not adapted for ocean traffic. With sufficient safeguards and control of power development, as well as of distribution, the commissioners held that the resultant development would be extensive and of great advantage to the country.

Mr. Harvie, who has had about thirty-five years of experience in engineering and the administration of public works—nineteen of which have been with the Montreal Harbour Commission—called attention to the fact that the port of Montreal is the point of interchange between ocean and inland traffic. The channel below Montreal is the corridor of access for ocean ships. The waterway above Montreal is the most important feeder of merchandise of all kinds,

particularly bulk merchandise from the West. The port of Montreal is the connecting link between the two—the point of interchange. The business of the port of Montreal has doubled itself about every six years. The total tonnage handled in 1921 was 6,223,924; in 1927, it was 11,921,173. The grain exported or delivered out in 1921 amounted to 138,453,980 bushels; in 1927, the corresponding quantity was 195,247,914 bushels. The greatest bulk imported, coal, in 1921 aggregated 1,042,716 tons, and in 1927 it was 2,448,477 tons. The revenue of the port of Montreal in 1921 was \$2,891,274; in 1927, it was \$5,453,951. The aggregate of net registered tons of shipping in 1921 was 2,891,956; in 1927, it was 4,992,486 tons. In 1921, the number of ocean ships entering the harbour of Montreal was 964; in 1927, it was 1,610.

Successive harbour commissions have endeavoured to anticipate the growth and development of harbour requirements, and the improvements and extensions planned have always fallen short of the actual growth and development. Since 1922, about twenty-seven million dollars have been expended to provide increased facilities at the port of Montreal, and at the end of the current year they would have fifteen million bushels storage capacity.

As a result of the recommendation of the Grain Elevators Committee in 1923, the control, construction and operation of elevator facilities at the port of Montreal had been vested in the single authority of the Board, with beneficial results.

Mr. Harvie was of opinion that the deepening of the St. Lawrence channel below Montreal and the deep-water development of the river above would increase the business of the port as it would mean bigger ships from below and above, and therefore cheaper transportation. The size of ocean vessels coming to the port of Montreal has been steadily increasing, there being at the present time passenger liners of 19,000 gross register, to be followed, he believed, by others of 20,000 tons register. In addition, there are freighters capable of carrying from 12,000 to 14,000 tons of cargo. He did not think any ocean vessel of any considerable size would go to the upper lakes. He believed they would tranship at Montreal. If there was a power development above Montreal—and he presumed the power development was really what would build the canal—the resultant cheap power would lead to the bringing in by large steamers of bulk cargoes of raw material essential to the operation of industries and factories close to the source of power, all of which ought to increase inevitably the business of the country.

Already there were indications of a still greater movement through the port of Montreal. The grain business is obviously increasing all the time, also the importation of coal. Importations of Norwegian pulpwood for the United States were being attracted to Montreal in preference to American ports, as also was the importation of potash—another bulk product, of German origin. Competition for steamship business was so keen, especially in the matter of grain, that a cut of one-eighth to one-quarter of a cent was sufficient to cause the port of Montreal to lose business to the more southern Atlantic ports. In response to questions by members of the committee, Mr. Harvie expressed the view that the improvement of the St. Lawrence would not injure the port of Montreal, but would be of benefit to it. It was his opinion that Montreal would always remain the head of ocean navigation. Montreal, although 1,000 miles up the St. Lawrence, was the most economic route on the North American continent, and closer to Europe than its most formidable rival—the port of New York.

ALEX FERGUSON, ASSISTANT GENERAL MANAGER, MONTREAL HARBOUR COMMISSION

(Pages 155 to 167)

Alex. Ferguson, assistant general manager of the Harbour Commission of Montreal, followed Mr. Harvie.

Prior to taking over his present position in June, 1927, Mr. Ferguson had for some years been superintendent of the government elevator at Port Colborne. In that capacity, he reached the conclusion that the water route from the head of the lakes to the sea was the most effective route in the transportation to Europe of grain from the Canadian west tributary to the head of the lakes, and that, therefore, the Great Lakes-St. Lawrence route was the controlling factor in the cost of transportation to the world markets of Canadian surplus grain. Already, at times of peak flow—usually in the spring and fall of the year—a big rush of grain caused a condition of serious congestion. Mr. Ferguson stated that on different occasions he had attempted to analyze the cost of the waterway movement with the object of arriving at the probable saving in the cost of carrying grain from head of the lakes to Montreal in large lake vessels. The result of these studies indicated a saving of 3 cents in cost to the vessels. For the purpose of this analysis he had taken a boat of present canal draft, 14 feet, carrying 85,000 bushels and costing about \$220,000. He had taken the cost of operation, interest at 6 per cent on the capital investment, depreciation and overhead, making a total annual cost of \$89,930 which, in an average season of 230 days, made the cost of operation per day \$391. To complete the round trip between Montreal and Port Colborne required 8½ days, at a cost of \$3,323. Loading and unloading charges—nine-tenths of a cent—\$765 gave a total cost for the round trip of \$4,088, or 4.81 cents per bushel.

The foregoing vessel could load to 16 feet draft between the head of the lakes and Port Colborne, and could carry 100,000 bushels. The round trip, without delays, would be eight days, and cost about the same, although naturally a little more coal would be burned. Adding loading and unloading charges at Fort William and Port Colborne, the total cost for the round trip was estimated at \$3,648, which gave a cost per bushel of 3.65 cents as against 4.81 cents between Port Colborne and Montreal.

Using a typical moderately sized vessel of the type operating between Fort William and Port Colborne, with a gross tonnage of 7,400 tons and a capacity of 10,000 tons, costing in the vicinity of \$700,000, the wheat load on 20 feet draft would be 370,000 bushels; the total average cost per day of operating such a boat would be \$865; operating between Fort William and Port Colborne, carrying grain, no return cargo, and no delays, completing round trip in eight days, would cost \$6,920; loading and unloading charges would add \$1,924, making a total cost of \$8,844. Therefore, the cost per bushel from Fort William to Port Colborne necessary to cover bare expenses, with the interest at 6 per cent, would be 2.39 cents.

Mr. Ferguson next assumed the same large lake vessel as operating between the head of the lakes and Montreal, a 20-foot draft, with no delays and no return cargo, a round trip of fifteen days, at a total cost of \$15,602, which would work out at 4.22 cents. From the foregoing, it will be seen that comparing the cost of grain carried by present upper lake vessels with canal-size vessels over the same route from the head of the lakes to Port Colborne, the cost by canal vessel from Fort William to Port Colborne is 3.65 cents, and by upper lake vessel from Fort William to Port Colborne 2.39 cents, showing a difference in favour of the larger vessel of 1.26 cents.

Mr. Ferguson gave the probable saving in cost of transporting grain from Fort William to Montreal in large lake freighters through an enlarged water-

way, as follows: Cost under present system, Fort William to Port Colborne, by typical large lake freighter, 2.39 cents; Port Colborne to Montreal, by typical canal freighter, 4.81 cents—total cost 7.20 cents. Estimated cost, Fort William to Montreal, by typical large lake freighter operating through an enlarged canal system, at 20-foot draft, 4.22 cents; estimated saving 2.98 cents or practically 3 cents.

Mr. Ferguson quoted the Dominion Bureau of statistics to the effect that the estimated ultimate theoretical capacity of the Cornwall canal was nine million tons, and of the Soulanges and of the Lachine canals, twelve million tons. The total traffic, both through and way, in 1927 was 7,912,952 tons. He had plotted a time tonnage chart which indicated that the total capacity of twelve million tons of the Soulanges and Lachine canals would be reached in 1935. If necessary facilities are not provided at Montreal and on the St. Lawrence within measurable time, a choke would occur at Lake Ontario and the surplus, unable to come through the St. Lawrence system, would overflow to other routes. It was difficult at this stage to say what those routes would be, but it is certain that the United States would make a strong bid for the business. Other routes might be, rail from Kingston or Prescott to Montreal, rail from Ogdensburg to New York or Albany, water from Oswego or Albany, and water from New York or Albany.

PROF. W. W. GOFORTH, MCGILL UNIVERSITY

(Pages 168 to 189)

Professor W. W. Goforth, of the staff of McGill University, in the Department of Economics and Political Science, appeared before the Committee on May 29, and dealt with the St. Lawrence problem under several main heads;—first, navigation and shipping, second, the agricultural factor, then, in order, the factor of hydro-electric power and the effect upon population and industries, then the railway factor and the potential effect of the Deep Waterway on Canadian railway traffic, and finally the financial factor.

Mr. Goforth was of opinion, based on analysis of cost ratios, that there would be very little likelihood, if any, of liners, either passenger or composite liners or freight liners, traversing the route above Montreal. It was, however, his opinion that a fair proportion of the tramp steamers which enter the St. Lawrence would traverse the proposed inland route because of the traffic possibilities of the interior. He did not hold with the theory that the improvement of the St. Lawrence would result in Chicago's becoming a formidable rival of Montreal as a grain port. In that respect, Chicago is unfortunately situated. It is not on the main route of the Great Lakes and therefore, in the opinion of Professor Goforth, could never hope to act as a chartering centre for the tramp traffic of the Great Lakes. The importance of tramp steamers lay chiefly in the moderating influence they exercised on liner rates. Rates from Montreal, which were at present higher than those from New York, would be brought to a level more in keeping with the distance involved. The present difference was considerably more than could be accounted for by the higher insurance charges of the Canadian route. He did not claim that present rates were excessively high, but only that they were higher than the difference in insurance charges on the two routes would warrant. As to the general understanding that rates were the same from all Atlantic ports, Professor Goforth said that that was true only to a very limited extent. The North Atlantic Conference merely sets minimum rates and does not attempt to interfere with maximum rates, and rates differed according to local competitive conditions.

If the Deep Waterway were completed, Professor Goforth was of the opinion that a saving of 4.8 cents, or 5 cents per bushel would result on grain

shipments from Fort William to Montreal. In reply to a question as to the probable saving on completion of the Welland Ship Canal and transfer at Prescott Professor Goforth gave the approximate cost of the movement from Fort William to Montreal in that case as 7.6 cents as against 9.6 cents under present conditions, and 2.8 cents, or 3 cents, more than his estimated cost for uninterrupted through traffic by large lake vessels.

The real menace of an uncompleted deep waterway to traffic by our Canadian outlets seemed to lie in the crystalizing of the Oswego-Albany route when the new Welland Canal is completed. That situation would transfer the leakage of Canadian traffic from Buffalo to a route which in many respects shows greater competitive advantages than any previous grain outlet via United States Atlantic ports. He was not referring to an all-American canal which he did not believe required serious consideration, but to a short rail haul coupled with extensive terminal developments at Oswego and Albany.

On the question of the present and potential area served by the St. Lawrence as an outlet for western Canadian wheat, Professor Goforth pointed out that the present watershed of grain traffic going east or west is relatively a line drawn north and south through western Saskatchewan about 60 miles from the Alberta boundary. In his opinion, the reason for enlarged shipments via Vancouver, and more recently Prince Rupert, was chiefly the very rapid growth of wheat production in the western Alberta region. Economies resulting from the St. Lawrence movement, whether three or five cents, would cause the dividing line to move westward into Alberta whereby the region served by the St. Lawrence would become considerably enlarged.

That brought Professor Goforth to the second factor, that of agriculture—the anticipated effect of the Deep Waterway on the net return of the western farmer and his general purchasing power which heretofore has not averaged more than 6 cents or 7 cents per bushel of wheat. Any increment arising from cheaper transportation would, from analogous experience in Kansas and elsewhere, result in greater attraction to agricultural immigrants, and also a tendency towards greater wheat production on the part of the present farmers.

In dealing with the hydro-electric power, Professor Goforth was personally of the opinion that not only should the canal be located on the Canadian side of the river, as suggested in the Ontario Hydro-Electric Commission Report of 1924, but the power-house for the development of Canada's share of the International power should be wholly within Canadian territory.

The question arose as to the ability of Ontario and Quebec to absorb, within a reasonable period, the enormous resources of hydro-electric energy which lie undeveloped in the St. Lawrence River. Export of any part of Canada's share of the power was not to be considered. The urgent demand of future industrial growth in Canada for every horse power of this potential wealth had been amply demonstrated and was now accepted practically without question. The outstanding fact of electrical growth in Canada had been the doubling of our developed resources in less than seven years. The rate of development in Quebec province has been still more rapid. There the consumption in kilowat hours had increased more rapidly than the rate of development, which leads to the logical conclusion that this basic product extending into almost every phase of industrial and domestic activity is not subject to the usual evils of overproduction. While it was hardly reasonable to expect this process of doubling every six or seven years to continue indefinitely, yet conservative opinion among experts is that Canada will continue to develop and utilize an increment of two and a half million horse-power every seven years for several decades to come. Of that amount the share of the two central provinces would approximate two million horse-power. Thus, even

making allowance for developments other than the St. Lawrence, Canada's share of St. Lawrence power would be urgently required by 1945 providing the normal expansion of Canadian industry and commerce is permitted to continue.

There were two major outlets or markets for St. Lawrence power which in addition to normal industrial growth should become increasingly important during the next two decades. The first concerned the development of an extensive electro-chemical and metallurgical industry in the valley of the St. Lawrence to refine and manufacture the rapidly growing supply of mineral products of the central provinces, notably of the northern region. Montreal, if provided with a large surplus power, would form an ideal centre of such activity because it possesses all other factors necessary to its success. It is the point of convergence of both Canadian railway systems and occupies a more truly central position in relation to major mining developments than any other point in the two provinces, and it possesses a larger floating surplus of industrial labour over a period of years than any other city in Canada.

The second major outlet or market is in the field of transportation and in that connection Professor Goforth discussed at some length the possible electrification of railway terminals, and, also, on the development of sufficient traffic density, say within fifteen years, the electrification of present trunk lines, which would cost approximately \$45,000.00 per mile.

Dealing with the anticipated growth in population which may be expected to result from development of the four million horse-power which would be available to Canada from the St. Lawrence, Professor Goforth quoted the *Journal of Electricity* of June, 1921, to show that 385 persons were employed, directly or indirectly, as a result of the development of each 1,000 horse-power. Applying this ratio to the latent electrical resources of the St. Lawrence would indicate a potential increase of 7,700,000 in Canada's population. This made the St. Lawrence development of greater import and advantage to Canada from the viewpoint of steady national progress than the construction even of transcontinental railways. Railway construction on a large scale had drawn great armies of labour immigrants from southern and central Europe. They were not farmers nor farm labourers and, as a usual thing, scattered on the completion of the work in hand. The advantage of the St. Lawrence development as compared with the construction of transcontinental railways would be that the industrial workers used in the construction of power and navigation work would progressively be absorbed into the manufacturing expansion which should follow the development of power.

As regards the anticipated effect of the St. Lawrence Deep Waterway on Canadian railways, he personally failed to perceive wherein they would be robbed of any valuable traffic. The railways should gain by an increase in grain traffic from western points to Fort William which should result in a cheapening of transportation. As to the eastern grain haul, which is even now subject to water competition and on which the net rate is necessarily small, little if any traffic would be diverted, because it is chiefly a matter of winter, late autumn, or early spring haul anyway. The railways should profit greatly by the increased industrial traffic emanating from the central provinces if the power resources of the St. Lawrence are developed. That traffic should consist chiefly of better class commodities of higher rate classifications. There would unquestionably be both a direct and an indirect increase in traffic of all classifications during the long period of construction. That should prove specially beneficial to the Canadian National Railways. Evidence produced at the freight rates enquiry of 1927 shows practically an even distribution of ten tons of originating traffic per capita in every province of the Dominion. If this simple principle were applied to the anticipated increase in population resulting from the power, the result would indicate a wide margin of gain rather than a loss to the railways.

On the following day, May 30th, Professor Goforth dealt with an apparent contradiction in his previous statement that hydro-electric power development necessarily implied a definite rate of population growth in and of itself. He pointed out that during the past seven years, that is, since 1921, Canada had more than doubled its electrical supply and there had been by no means a similar increase in population. What had apparently happened was that the labour requirements of industry founded upon this new development of electricity had been drawn not from immigration, but from rural areas, chiefly due to the collapse of agricultural prices after 1920. That caused a considerable movement from the farming area to the industrial centres, and that flight would have been greater and would have taken the form of a much larger emigration but for the surplus labour requirements of the industrial centres founded upon electrical power. However, a definite reaction has already set in partly due to the recovery of agricultural prices and partly to the desertion of a great many farms which were potentially profitable to operate, and we could not be expected to draw from rural areas the further labour requirements of industrial centres. It is Professor Goforth's considered opinion that future industrial labour requirements will, to a great extent, have to be supplied from immigration, coupled with the retention of our natural increase, which has roughly averaged 15 per cent per decade since confederation. There was substantial evidence to show that the anticipated requirements of land settlement are greater than the ability of rural areas to supply them by natural increase.

Turning to another feature of population, namely, the problem of unemployment, Professor Goforth was of the opinion that the industrial development anticipated from the St. Lawrence project would tend to ameliorate our very serious seasonal unemployment. Professor Gilbert Jackson of Toronto university, who is also the economist of the Bank of Nova Scotia, had demonstrated that the peak of Canadian immigration comes about three months too late in every year to give a sufficiently satisfactory period of prospective employment to the immigrant. The peak comes at the end of July or the beginning of August instead of in May. The labourer gets only the harvest period of a few weeks before he finds himself out of employment. This late peak which results from a great agricultural demand for labour during the latter part of the summer is a serious discouragement to immigration. If the stimulus to immigration were industrial rather than agricultural the peak would be reached earlier and would therefore provide a longer period of employment to the immigrant after landing.

Finally, Professor Goforth discussed the question as to whether agricultural expansion in the Canadian and American wests would depress the wheat markets of the world and result in the collapse of wheat prices. Mr. A. O. Baker, Economist and Statistician of the United States Department of Agriculture, was quoted to the effect that the world's population is increasing, in spite of such exceptions as France, at the rate of 20,000,000 to 25,000,000 per year, and he also found that in practically all except Anglo-Saxon countries there was a definite rise in the per capita wheat consumption. Mr. Baker claimed that in the United States, as distinct from all others, there was an actual decline in the per capita consumption of wheat, the explanation being that after a certain standard of living is reached the tendency is towards more expensive foods like fruits and meats rather than in the direction of bread and wheat products. Thus, the prospect of the United States supply of wheat being kept for local consumption and not sent into the markets of the world is much less than generally imagined. It was Professor Goforth's opinion that the most probable future tendency of wheat markets is a more rapid growth of demand than the great wheat producing countries will be able to supply. In other words, the probable tendency of wheat prices is upwards over a long period, and that any agricultural expansion in the Canadian west will not result, except possibly for a brief period, in any depression in markets.

MALCOLM NEIL GILLIES, CANADIAN MARINE SUPERINTENDENT,
ANCHOR-DONALDSON LINE, MONTREAL*(Pages 190 to 193)*

Malcolm Neil Gillies, Canadian Marine Superintendent of the Anchor-Donaldson Line, Montreal, appeared before the committee on May 30th, and dealt with liner tonnage entirely. In the period of navigation for the St. Lawrence, say, from May 5th to November 25th, about 205 days, the liners made ordinarily seven voyages, though the first ship would make eight during the season, which would mean a twenty-eight-day run.

In considering inland marine traffic, it would have to be borne in mind that the liner must stop at Montreal first for discharge of Montreal cargo and package freight requiring to be forwarded by fast freight to interior destination, even to such points as Toronto, which is on the Great Lakes-St. Lawrence route. Necessity to dock at both Montreal and Toronto would entail the expense of two ports, as compared with one, with shed accommodation at each place and the necessary waiting time in port, which would be four days longer than the average. Other considerations were that ships going into the lakes through the canal would not get minimum insurance, would require to be stiffened longitudinally to take the buffeting beam winds in the canals, and would also require to be assisted by tugs in making lock entrances. All this would mean considerable expense, and the time consumed would be $3\frac{1}{2}$ to 4 days between Montreal and Toronto. It would mean about 12 days that the ship would be in inland waters, which would entail about 100 per cent increase in insurance. There would be, in addition, eight days' added coal consumption. They were in the habit of bunkering for the round trip at Glasgow, with coal about \$4.50 a ton; at Montreal, it is \$7.40 for the long ton, and the inland extension of the voyage would make it necessary to take on about 500 tons at Montreal at the \$3 additional charge. The round trip to Toronto would require 40 days; thus, they would lose two voyages in a season of 240 days. That meant that for the five remaining voyages they would require to have earnings equal to the seven ordinary voyages. As far as passenger boats were concerned, Mr. Gillies was firmly of opinion that they would never dream of going west of Montreal, nor would fast freight liners. Tramp steamers, of course, if offered sufficient inducement, would go anywhere, but if cheap vessels were used, the shipper would complain because, unless he uses a first-class vessel, insurance on his cargo would go up.

Mr. Gillies, in conclusion, referred to the trouble experienced each season in regard to St. Lawrence river water levels, and was of opinion that the day would come when it would be necessary to dam the St. Lawrence about ten miles above Quebec, where there is a sixteen-foot tidal rise and fall, to hold back the water required by navigation for Montreal, Three Rivers, and possibly Sorel.

"TRANSPORTATION ECONOMICS OF THE GREAT LAKES-ST.
LAWRENCE SHIP CHANNEL"*(Pages 294 to 296)*

Appendix No. 5 consists of a reference supplied by Hon. Senator Béique, summarizing a study of transportation economics of the Great Lakes-St. Lawrence ship channel by Alfred H. Ritter, a United States transportation and port specialist. From this study the following conclusions are summarized:—

"The study shows that the waterway as proposed will be thoroughly practicable for ocean vessels. The amount of restricted navigation will not be sufficient either to interfere with its use or to have any important effect upon rates. While a depth of 25 feet would serve to permit an

important development of traffic, it is believed that a preliminary depth of at least 27 feet should be provided, and that a depth of 30 feet will be found most useful. A depth of 30 feet will meet all requirements of freight traffic. The large combination passenger and freight liners are not essential to the success of this route. There is a very large volume of traffic now moving between the territory to be served by this waterway and the seaboard, both in foreign and domestic trade. The greater proportion consists of commodities of a nature which will take advantage of reduced transportation costs. The interested traffic is found to be approximately 30,000,000 tons annually, but it is not possible to state just what part of this interested traffic will actually move over the waterway. The indicated savings are sufficient, however, to warrant the belief that a large part of it will be benefited either directly, through the use of the waterway, or indirectly, through the influence which the waterway will exert on rates via competing routes. The probable transportation savings on grain alone are equal to interest at 5 per cent on \$800,000,000. while the annual transportation savings plus farm price enhancement are estimated to equal or exceed the total expense of the improvement properly chargeable to navigation, under the original project submitted to Congress by the International Joint Commission. The waterway will facilitate and encourage the development of the important agricultural and industrial territory tributary to the Great Lakes, and will stimulate the foreign and domestic trade of this region. In making possible more economical communication between this territory and points on and near the Atlantic, Gulf and Pacific coasts, it will benefit directly or indirectly the entire United States.

"The St. Lawrence Ship Channel is not a rival to any inland waterway, constructed or proposed. It is an extension of existing ocean routes by means of which vessels from all parts of the world may reach the rich and populous territory bordering on the Great Lakes. It will establish a new and fourth seacoast, and a sea base from which tributary rail, water and highway routes will radiate. It is as essential to the people of the United States and Canada as are the Straits of Gibraltar to southern Europe, the Dardanelles and Bosphorus to the people of Russia and the Balkans, and the Baltic navigation to northern Europe. No logical plan to meet our future transportation requirements can fail to recognize its basic position. The project is not sectional in character, but is of outstanding national and international interests."

COL. A. E. DUBUC, CHIEF ENGINEER, DEPARTMENT OF RAILWAYS
AND CANALS

(Pages 194 to 214)

Colonel A. E. Dubuc, Chief Engineer, Department of Railways and Canals, who appeared before the Committee on May 31, dealt particularly with the traffic possibilities of the present canal system, and, in that connection, endeavoured to interpret the figures collected from the different canal offices and published by the Dominion Bureau of Statistics Transportation Branch, Department of Trade and Commerce, from year to year. He pointed out that, for statistical purposes, the main canal system from the Great Lakes to Montreal is divided into three sections—1st, the Sault Ste. Marie lock connecting lake Superior with St. Mary's river and lake Huron; 2nd, the Welland canal connecting lake Erie with lake Ontario; and 3rd, the St. Lawrence canals connecting lake Ontario with Montreal. A boat starting from Fort William for

Montreal would, therefore, be registered as to tonnage and cargo at three points, and, unless that were kept in mind, one might easily get a very misleading picture of what the traffic has really been. There was no doubt that traffic on our main canals had increased very materially, particularly since 1921, but those who wished to prove that our canals were decadent and traffic decreasing since say 1913 might do so by eliminating first of all freight of American origin and by taking into account only freight of Canadian origin passing through Canadian canals and leaving out of the reckoning all Canadian freight which, for convenience, makes use of the American locks at Sault Ste. Marie. On that basis, it could be shown that, in 1913, 11,130,875 tons of Canadian freight passed through Canadian canals, while in 1926 the same class of freight passing through the same canals totalled 9,656,190 tons, a decrease of 13 per cent. That arrangement, if intended to prove that traffic in the Canadian canals in the same period had decreased, would be found to be entirely wrong and contrary to facts, as there was, in the same period, on the St. Lawrence canals, an increase of over 102 per cent in cargo carried.

It was possible to show a decrease in Canadian traffic using Canadian canals because of the fact that the year 1913 was the year before the United States completed a big new lock at Sault Ste. Marie (the Davis lock), previous to which, practically all freight of Canadian origin, and a large proportion of freight of American origin, passed through the Canadian lock, it being the largest and most convenient up to that time. In 1913, 4,954,734 tons of freight of Canadian origin, and 37,744,590 tons of freight of American origin, went through the Canadian lock at the Sault, a total of 42,699,324 tons. In 1926, only 1,207,216 tons of freight of Canadian origin, and 216,059 tons of American origin, went through the same lock, a total of 1,423,275 tons, representing a decrease of 41,276,049 tons.

Under treaty arrangement with the United States, traffic of both countries has the same rights and privileges in the use of federal canals belonging to either country, and it was wrong, therefore, for purposes of comparison, to restrict consideration to Canadian traffic using purely Canadian canals; thus, the figures 11,130,875 for 1913, and 9,656,190 for 1926, failed to take into account 2,285,259 tons in 1913, and 8,338,239 tons in 1926, of Canadian traffic, which, in those years, made use of the American locks at Sault Ste. Marie instead of the Canadian lock on the opposite side of the river. This showed that, on the restricted basis of comparison, 6,052,980 tons in favour of 1926 failed of consideration. Such an interpretation of table 39 of canal statistics was absolutely misleading and in direct contradiction to the facts.

To ascertain the capacity of our main canal system between the Great Lakes and Montreal, it was necessary to find the point of greatest congestion. At Sault Ste. Marie there was a traffic capacity many times that which is available downstream. On completion of the Welland Ship canal, there would be a capacity at that point many times that of our present system. Between lake Ontario and Montreal, the canal with the largest capacity would be found to be the most recently constructed Soulanges canal completed in 1900. Its capacity could be estimated at about 14,000,000 tons of freight per year, based on official experience and the seasonal manner in which the traffic presents itself.

The Lachine canal could be reasonably compared with the Soulanges canal as to capacity. The two weakest points on the St. Lawrence canal system were locks 15 and 17 of the Cornwall canal, and the Morrisburg canal. The reason for that was the fact that at Cornwall the two lower locks referred to are almost in flight with very little pondage between, which rendered the feeding of water rather slow. There was equally a congested point at the upper end of

the Morrisburg canal owing to difficulty at low water stages of entering on account of the short approach wall and a cross current, which, at times, causes difficulty to boats making the entrance.

In discussing canal records, Colonel Dubuc said that canal traffic could be calculated in three ways. It could be done by computing the registered tonnage of the boats that go through, but that was not particularly accurate as it is immaterial in the operation of the lock whether the boat passed be a big boat or one of medium size. Whatever it is, the lockage must take the same time. In 1913, the registered tonnage of the boats east and westbound through lock 15 totalled 3,490,893 tons. In 1927, that total was 6,568,933, an increase of 88 per cent.

Another method of computing the traffic passing through a canal was by weight of actual freight carried. In 1913, there passed through lock 15, 3,470,928 tons of cargo. In 1927, this had become 7,023,808 tons, an increase of 102 per cent over 1913. Colonel Dubuc did not consider the foregoing a very accurate method, as time was lost and boats must be let through, whether loaded or light. A more accurate and better way, he believed, was to compile the number of actual lockages made.

In 1913, there were 4,681 lockages at lock 15, or an average of about 20 lockages a day on an average season of 234 days. In 1927, the total lockages were 6,765, or an increase of 45 per cent in actual lockages over 1913.

The probable maximum daily capacity for lockages through locks 15 and 17 on the Cornwall canal was said to be 40 to 42. In August, 1927, there were 1,911 lockages, representing an average of 33 per day; in September, 986 lockages, representing a similar average; in October, 991 lockages, representing an average of 32 per day; and in November, 815 lockages, representing an average of 27 per day. In the early part of the 1927 season, in April, there were 221 lockages, representing an average of 28 per day; in May, 953, an average of 31 per day; in June, 990, an average of 33 per day; in July, 725, an average of 23 per day. With the last six or seven years as a guide, it was Colonel Dubuc's opinion that, if the construction of the proposed deep waterway was commenced immediately, long before it could be completed, there would be a congestion in the present canal system which would not be able to cope with traffic offering, and that surplus traffic would be diverted either to American sources or by rail from lower lake Ontario to Montreal. It might, of course, equally be diverted by rail to Pacific ports, by boat to Georgian Bay ports and rail to seaboard, or to the Hudson Bay route. Taking 32 as the average lockages at lock 15 for the 1927 season, and the maximum capacity at about 42, it follows that the Cornwall canal was operated to a little over 75 per cent of its capacity during the 1927 navigation season.

Considerable discussion followed as to the possibility of improving conditions at Cornwall by the duplication of locks or by the construction of new locks of Welland ship canal size in length and present St. Lawrence canal depth. Colonel Dubuc presented arguments to show that there would be no advantage, from the shipping standpoint, in constructing such immense shallow locks as the last named, and, as to duplicating the present locks, while that could be done at Cornwall at a cost of possibly \$1,500,000, the next weakest point at Morrisburg would require to be corrected, and, even then, they would only succeed in increasing the efficiency of the St. Lawrence system as a whole to the capacity of either the Lachine or Soulanges canal.

If the trade on the St. Lawrence increases in the future as it has in the past, and if the traffic presents itself in seasonal periods as heretofore, improvement of the present system will be absolutely necessary. Otherwise, the present capacity of the canals would, in the opinion of Colonel Dubuc, be exhausted by about 1934. The present situation means that there is only 25 per cent of

reserve capacity in the Cornwall canal where the increase last year alone in actual tonnage was 30 per cent, and in lockages 22 per cent, over the previous year. To take care of all the traffic which it is reasonable to assume will present itself in the next ten years, even anticipating a yearly increase of only 10 per cent, would necessitate the rebuilding of all the present canals between lake Ontario and Montreal, the cost of which would be out of the question in view of the fact that it would be only a temporary relief pending the building of the deep waterway. Relief might be afforded by the establishment of a lower lake terminal port at Prescott, Gananoque, or Kingston, where freight might be transferred and forwarded to Montreal by rail until such time as the deep waterway were constructed.

In connection with the figures mentioned by Colonel Dubuc in his evidence, the following tabulated statements were filed and will be found on pages 209 et suite:—

1. Table 39—Dominion Bureau of Statistics, traffic on Canadian canals;
2. Table 40—Dominion Bureau of Statistics, traffic through Sault Ste. Marie canals;
3. Traffic and freight tons through Sault Ste. Marie canals, showing yearly from 1911 to 1927 inclusive, freight of Canadian and American origin through Canadian and American locks;
4. Traffic, Lock 15—Cornwall canal, including number of lockages, vessel registered tonnage and freight carried yearly from 1913 to 1927, inclusive;
5. Cornwall canal—Summary of lockages through lock 15 during 1925, 1926 and 1927, giving total of monthly eastbound and westbound lockages and daily averages;
6. A statement of daily lockages through lock 15, Cornwall canal, during the season of 1927, showing separately downbound and upbound traffic.

R. A. C. HENRY, DIRECTOR, BUREAU OF ECONOMICS, CANADIAN NATIONAL RAILWAYS

(Pages 215 to 245)

R. A. C. Henry, B.A., B.Sc., Director of the Bureau of Economics, Canadian National Railways, referred to the investigation conducted by the Grain Elevator Committee, of which he was a member, and which reported to the Montreal Harbour Commission in 1923. The purposes of that investigation were three-fold: first, to investigate the situation respecting the ownership of elevators at bay ports owned or controlled by the various departments of the Federal Government, including Canadian National Railways, in relation to elevators held by private individuals at the same points; second, to see if the facilities, especially of those under the control of the Government, directly or indirectly, could not be co-ordinated; and third, to investigate generally the grain movement east from the head of the lakes in relation to transportation facilities. As a result of a day-by-day investigation covering movement of grain in the years 1921 and 1922 conducted by this commission, it was able to present a precise analysis of the movement of grain from interior points to shipboard at Montreal, as a result of which much information was secured and recommendations made which have been of great value in co-ordinating and speeding up the movement of grain for export through the port of Montreal.

As a result of this study and a further study of the situation in 1926, Mr. Henry presented a tabulation indicating that a possible saving of 3 cents a bushel on grain shipments might be expected following the completion of the Welland Ship canal and the enlargement of the St. Lawrence canals. Mr. Henry's figures were based on 1926 traffic when the rate from the head of the lakes to Montreal averaged 9.22 cents a bushel. Over the period 1922 to 1926, the average rates worked out at 3.05 cents from the head of the lakes to Port Colborne and 6.01 cents from Port Colborne to Montreal, a total of 9.06 cents. Those rates were

divisible into various factors. Thus, the rate from Fort William to Port Colborne had been divided into the shovelling charge, which costs at Port Colborne 0.435 cent, and hull insurance, which costs 0.265 cent. That is to say, the rate has to absorb 0.7 cent, which leaves a balance of 2.8 cents, which has been further divided into two factors: the factor due to running time, and the factor due to terminal delay. The portion of the rate assessed against terminal delay is 0.65 cent, leaving a balance for running time of 2.15 cents. This latter figure was translated into cents per ton mile, and worked out at 0.08 cent per ton mile. The idea of this was to ascertain the influence of distance and sailing time under the two sets of conditions. Taking the same procedure with respect to the Port Colborne-Montreal rate, Mr. Henry found that the absorptions of shovelling, elevation, and insurance amounted to 1.44 cents. That left 4.66 cents. The terminal time was equivalent to 0.96 cent, leaving the amount for running time at 3.7 cents, equivalent to 0.16 cent per ton mile.

Mr. Henry then took the sailing time, and eliminated the time involved in terminal delays, reducing it to the basis of equivalent distance, making allowance for restricted channel and lockages. That took into account the average time consumed, and on that basis it was found that the equivalent distance from Port Arthur to Port Colborne was 900 miles, and from Port Colborne to Montreal 770 miles. Nine hundred miles at 0.08 cent per ton mile equals 72 cents per ton; 770 miles at 0.16 cent per ton mile equals 123.20 cents per ton, or a total of 195.20 cents per ton for the complete movement. That was equivalent to 5.85 cents per bushel.

The cost through the proposed enlarged canal would, Mr. Henry figured, be equal to 1,440 equivalent miles at 0.08 cent or 115.2 cents per ton. That was the equivalent of 3.45 cents per bushel. There would, therefore, be a saving of the difference between 3.45 cents and 5.85 cents, to which had to be added the transfer charge, estimated at 0.6 cent, making the total of 3 cents already referred to as the saving per bushel which might reasonably be expected on grain traffic through the St. Lawrence and Welland improvements.

Dealing with the factors controlling rates in the territory affected by the St. Lawrence waterway, Mr. Henry said that an analysis of the rates charged by the carriers on the Great Lakes and those engaged in the movement of traffic through the canals indicates that during the periods of peak movement those carriers charged a rate considerably in excess of the cost of performing the service. That rate, in fact, represented substantially what the traffic would bear. On the other hand, during slack periods, the limiting consideration in establishing rates appeared to be the amount required to pay the actual out-of-pocket expenses due to operation. In the final analysis, however, the amount that the lake and canal carriers received for the transportation service performed must be sufficient to pay all operating charges, all interest charges, and provide a margin of profit. Otherwise, there would be no incentive to continue in the shipping business.

In regard to railway rates on grain from lake and bay ports to Montreal and Atlantic ports, it was safe to say that the Buffalo-New York rate has been the controlling influence because of the fact that the mileage between Buffalo and New York is shorter than from any other lake or bay port to the seaport. This distance is 396 miles, and the rate in effect a year ago between Buffalo and New York was 15.17 cents per 100 pounds, or about 9.1 cents per bushel. The rate on export wheat from bay ports to Montreal is 14.34 cents per 100 pounds, or 8.7 cents per bushel. The rate on export wheat from Canadian lake ports to Halifax, St. John, Portland, and Boston is 15.17 cents, the same as that obtaining to New York from Buffalo. But there are no rates, and, consequently, no movements of grain from the bay ports to New York. Asked what would be the effect of the deepening of the St. Lawrence on the traffic on the railways of

Canada, Mr. Henry answered that there would probably be a drop in the rail handlings of grain for export, but in addition to the grain handled for export there is a substantial movement of grain that is consumed domestically or milled into flour from the bay port area. There would be a compensating factor from the fact that the St. Lawrence waterway would enable a larger amount of lower grade commodities to be moved at a cheaper rate, which would mean that new industries could be developed that are not possible now because transportation charges are too great in relation to the total value of the product.

As illustrating the proportion of grain movement ex rail and ex boat, Mr. Henry stated that in 1923 the quantity of grain delivered by the railways at Montreal amounted to 45,000,000 bushels. The amount received by water from the upper lakes was 74,000,000. In 1924, the quantity handled by the railway was 53,000,000 and by water 112,000,000. In 1925, the railway shipments dropped to 39,000,000 and water shipments had risen to 124,000,000. In 1926, a smaller year, the railway shipments had dropped to 31,000,000 and the water shipments to 105,000,000. In 1927, the amount received by rail rose to 35,000,000, and by water to 154,000,000. Water transportation had always been cheaper than practically any other form. For that reason, water transportation had always controlled rates. To begin with, capital cost of equipment was less. Even with the most expensive type of boat, there is no roadway to provide for such facilities as grading, bridges, etc., required for the operation of trains, and which cost anywhere from \$25,000 to \$75,000 a mile. In the next place, the cost of operation itself per ton is much less. By way of illustration, Mr. Henry stated that the cost of a canal-sized boat was \$214,000—about equivalent to the cost of a 60-car train, including motive power. An upper laker—that is, a 12,000-ton boat—would be equivalent to four trains of 75 cars each, the capital cost of which is a million dollars. The railways are naturally forced, if in competition with the waterways, to reduce their rates to something which is a bit above cost; the boats, on the other hand, wanting the business, will make a rate a little lower than the railways can afford to carry, and, up to capacity, they take the business. From the railway point of view, as already stated, the controlling factor was, and probably will be for some time to come, the Buffalo-New York rate. The reason for that was a liner tonnage available at New York, where there seems to be an annual liner capacity in the vicinity of 175,000,000 to 200,000,000 bushels.

Some discussion arose as to the attraction of grain to American ports for movement by tramp vessels. In that connection Mr. Henry stated that because of expenses involved in docking, etc., tramp vessels did not as a rule go to New York, but to Baltimore, Philadelphia, and Montreal. The present prevailing differential against the New York rate on the export movement of grain in favour of Baltimore and Philadelphia is half a cent a hundred. The Interstate Commerce Commission of the United States has been asked to increase this differential to 1.2 cents.

Asked to explain why 140,000,000 bushels of Canadian grain went via Buffalo to New York for export last year when the rate was 2 cents a bushel less by the St. Lawrence, Mr. Henry stated that the grain in question came in late in the season and could not get out by the St. Lawrence route. It was stored at Buffalo either in the elevators or in boats afloat, and went out gradually during the winter. Montreal had only seven months' navigation and there were no rates comparable from Montreal to Atlantic ports. If there are they are about the same as the Buffalo rates, and any shipper having grain would have to pay just as much from Montreal for the balance of the trip as he paid from Buffalo. Therefore, there would be no advantage in taking it down to Montreal for storage purposes.

Ocean rates from New York and Montreal to Europe are not necessarily the same. Sometimes they are not. Asked whether the deepening of the St. Lawrence would benefit the western farmer, Mr. Henry replied that if the capacity of the existing canal system is reached in a short time, it would mean that the water rate from the head of the lakes to Montreal with respect to quite a substantial volume of grain at any rate would not be governed by the cost of carriage by water, but by the rate which the railways charge from bay ports and from Buffalo, and naturally the cost of the movement of grain would tend to rise. In the second place, the 3 cent saving to which he had referred earlier in his evidence would not materialize. The situation as affecting the western farmer was rather extraordinary. The average haul from the centre of production to the head of the lakes is 910 miles, which meant that every bushel of grain had to stand a transportation charge of the equivalent of that mileage, before it got to the head of the lakes. In terms of cents per bushel, that is approximately 14 cents to the head of the lakes. After that, even if the grain does take the waterway, there are 1,215 miles remaining to Montreal, costing a little over 9 cents per bushel. After that, there is the rate from Montreal to the United Kingdom, where most grain is marketed, which costs at the present time from 4.5 cents to 10.5 cents per bushel, a total of from 28.5 cents to 33.5 cents a bushel.

In considering the Canadian farmers' position, Mr. Henry referred to the possibility of Russian competition in the European market, where the farming investment is much less, as well as labour costs. There, possibly transportation costs are somewhat higher, as also was the case in the United States. Rather serious competition came from the Argentine and Australia. The Argentine has a higher water rate of course, but a lesser land haul. In consideration of all these factors, Mr. Henry was inclined to think that the deep waterway would be of substantial advantage to the western farmer.

Mr. Henry confirmed the views of other witnesses respecting the possibility of ocean liners going through to Port Arthur for cargoes. He did not believe any liner at all would go up; the tramp steamer might.

Mr. Henry agreed with the Right Honourable Mr. Graham that the development of the waterway would open up greater facilities for traffic in both directions, and would redound to the benefit of Montreal as well as to the rest of Canada. Mr. Henry went on to refer to the industrial development which might reasonably be expected to accrue to the territory tributary to the power developments which would take place on the St. Lawrence. Estimates of such possible developments were always difficult to make in advance, but he referred to what had actually taken place in the States of New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois and Michigan—the most highly industrialized districts in the world. Those States in 1925 had a population of 45,000,000. They had primary horsepower employed in industry to the extent of 19,145,000. Looking back at the situation from 1900, the population of those States in 1900 was 29,572,000, and the horse power was 5,176,000. In 1910, the population had increased approximately 5,000,000 to 34,000,000, and the horsepower had increased from 5,000,000 to 9,000,000. In 1920, the population had increased from 34 to 41 million, and the horsepower from 9 to 15 million. From 1920 to 1925 the population had increased from 41 to 45 million, and the horsepower from 15 to 19 million.

Looking at that another way, the industry is measured in 1900 in the following fashion: Wages, \$1,146,000,000; cost of materials, \$3,773,000,000; value of products, \$6,601,000,000. In 1925, those figures were: Wages, \$6,465,000,000; cost of materials, \$20,362,000,000; value of products, \$36,577,000,000.

These States are rather peculiarly situated, because they either lie adjacent to or they actually contain very large resources in coal, coal in most of these

cases being the source from which the power is developed. Mr. Henry did not suggest that the rate of progress along the St. Lawrence would equal that. He was merely pointing out what had happened in the country to the south of us where there had been a tremendous power and industrial development.

In the course of the discussion, Mr. Henry dealt with the possibility of the diversion of grain traffic to American routes or to the railways in the event of undue delay in dealing with the St. Lawrence situation following the completion of the Welland Ship canal. He favoured the St. Lawrence canalization, and did not consider it made any difference whether the improvement were placed on the Canadian or American side of the river in the international section. As to that, he had no preference.

Any disadvantages that might result temporarily to the railways would, Mr. Henry thought, be offset by corresponding advantages. As to that, he cited the motor industry. It was true that there had been no increase in the passenger business of the railways for a number of years, due largely to the automobile, but it was also a fact that the freight development which had resulted from the manufacture of motor cars had been of very great benefit to the railways. In that connection, the Right Honourable Mr. Graham developed the seeming paradox that the more traffic increased by water the more it also increased by rail.

In connection with Mr. Henry's evidence, the following tables were filed:—

Table 1, Fort William-Montreal—Table of equivalent distances and sailing time;

Table 2, Rates on grain from head of lakes to Port Colborne and from Port Colborne to Montreal;

Table 3, Summary of value of manufactures in following States;

Table 4, Manufactures prime movers, motors and generators by numbers and rated capacity;

Table 5, Tonnage through Panama Canal.

JAMES PLAYFAIR, PRESIDENT AND GENERAL MANAGER, GREAT LAKES TRANSPORTATION COMPANY

(Pages 246 to 260)

Mr. James Playfair, President and General Manager, Great Lakes Transportation Company, Limited, Midland, Ont., expressed the view that even on completion of the Welland Ship Canal and the establishment of a lower lake terminal at Prescott, grain would not be carried any cheaper than at present. The reason for this was that the vesselmen now carry grain all summer at a loss ---as, indeed, they had been for several years past. He complained that the vesselmen were now subject to the dictation of the wheat pool as to freights. The pulpwood trade was a little better, but that was just a small trade on which supply and demand had kept the rate up; but even that had gone off a little the last year on account of so many boats coming through from the Old Country.

Since the wheat pool came into existence they will not book ahead at all. All they would do was to hammer the vesselmen down. If the steamship men were strong enough, they might secure a decent rate, but steamship men did not stick together. They started out this spring at 10½ cents, and there was no business offering. Then they made a cut to 10 cents, and next to 9½ cents, and, at the moment, he thought the rate was 8 cents through to Montreal. Asked whether it would stay low until the next wheat came in, Mr. Playfair replied that it would stay low as long as the pool controlled it. In the fall of the year, when the big crop rush came, the rate could be jacked up a little.

Chairman TANNER: "You say it is the pool that controls the rates; not the steamship people?"

Mr. PLAYFAIR: "The pool, they are the boys. Call them the farmers. The farmers control the rates, and they can give you what they like. For instance, there is over 60,000,000 bushels in Fort William now piling up, and over 15,000 cars loaded. There is an embargo on grain coming into Fort William and the boats cannot get a load. There is no demand for wheat."

Mr. Playfair added that it was not a case of rates at all, but due to the market. He was skeptical of any saving on grain transportation, even on completion of the through waterway, notwithstanding the positive statements of economists. He stated that the Premier of Manitoba had claimed that the deep waterway would lower the rates on grain 7 cents. Mr. Playfair said that he had written the Premier of Manitoba in reply, and told him that he would take the contract to move all the grain from Fort William for 7 cents. How, therefore, could he save 7 cents? He maintained that the rate from Fort William to Montreal did not average 7 cents the year through.

In that connection, Mr. Playfair, at a later date, supplied a statement of the rates from Fort William to Montreal as they prevailed during the season of 1927, as follows:—

	Cents
March and April..	9 $\frac{3}{4}$
May..	8 $\frac{5}{8}$
June and July..	5 $\frac{9}{8}$
August..	8 $\frac{5}{8}$
September..	8 $\frac{1}{2}$
October..	10 $\frac{1}{4}$

In forwarding this schedule, Mr. Playfair wrote:—

"It will be noticed that June and July are very low, and at this figure the boat owners lose money. There is very little grain to move at this time of the year, so they take whatever they can get, hoping things will take a turn, but as a rule they do not."

It was Mr. Playfair's opinion that even on the completion of the Welland Ship canal, the big boats would continue to turn at Lake Erie ports, and would not go through to Prescott. He gave as his reasons the superior terminal facilities at Buffalo, with consequent quick despatch, which would enable vessels to make two trips where they could only make one to Prescott. Personally, he would rather go to Buffalo for a cent less than go to Prescott for the additional cent. He thought also that the insurance underwriters would increase the premiums on the boats going through the canal. This year the underwriters would not take any risks at all on canallers, which, consequently, have been running without insurance. As to the congestion of the present St. Lawrence canals, it was Mr. Playfair's view that this was being brought about by the large increase in pulpwood shipments. After the grain boat reached Montreal and unloaded, it would go to Matane, Anticosti or Seven Islands and load pulpwood for Ogdensburg, Thorold and Lake Erie.

Personally, he did not think that ocean vessels would go through to the Great Lakes unless a lot of changes were made. Ocean vessels are equipped with small rudders, and to enable them to make quick bends in the river, the little rudder would not do. It would also be necessary for them to take on pilots, and the insurance companies would push up the rates. There was also the question of through cargoes; package freight was already pretty well taken care of at present, and vessels would not get many through loads from the Old Country to the head of the lakes unless of Scotch whiskey or something like that. In addition to the pilot, it would be necessary to have two different

crews—one for the ocean and the other for inland waters. As to these vessels going through to the head of the lakes and loading grain for Liverpool, Mr. Playfair thought it could be as cheaply handled by lake vessels and transferred to ocean vessels when the added expenses of inland navigation were taken into consideration. Canada was greatly handicapped by the fact that grain could not be shipped by water in winter. That accounted for the late rush and winter storage of so much Canadian grain at Buffalo, from which point a number of railways lead to United States seaports.

Mr. Playfair expressed the opinion that cheaper grain rates would mean that Canadian vesselmen would "go broke". He was of opinion that the Great Lakes steamship lines to-day were not making any money. Personally, he thought it would be better not to improve the waterway below Prescott until financial conditions warranted. If the Government would give him the interest on the proposed St. Lawrence improvement, he would move all the grain from Fort William for nothing.

Chairman TANNER: "Your view is that the deepened waterway would not give cheaper rates?"

Mr. PLAYFAIR: "It is not worth the expense you are going to."

Mr. Playfair complained of unfair competition by the big American boats. He claimed that they were breaking the coastal laws in loading Canadian grain at the head of the lakes, unloading at Buffalo, and reloading to smaller American boats there for transport to Montreal. Canadian vessel owners could not go to Chicago with a Canadian boat and load in Chicago, bring it to Midland, and ship out of Midland to New England. Canada was letting the Yankees do what the latter would not permit Canadians to do.

There was also some discussion over the practice of permitting United States boats to load Canadian grain for storage during winter at any point on the Great Lakes. That arrangement permitted Buffalo to secure a great deal of Canadian grain for winter handling. As indicating the different interpretations permitted of the coastal laws in each country, Mr. Playfair stated that his company was the first to start carrying motor cars from Detroit via Windsor, to Chicago, and it was a profitable business. They made only five trips before they were stopped by the United States Government, which claimed that they were breaking the coastal laws. Mr. Playfair went to Washington to investigate, and was told he could make one more trip, but if more he would be stopped and fined. A similar interpretation of the coastal laws would be very much in the interest of Canadian shipping. It would be a fine thing if by means of a terminal at Prescott they could secure for Canadian handling the Canadian grain which at present goes to Buffalo. The Americans having from 60,000,000 to 70,000,000 tons of ore to keep their boats busy each season were in a better position than the Canadian vessel owners, who had nothing to carry all summer but grain and a little coal. Personally, he would not bother much about those last trips for storage purposes, although he did not like to see so much of the grain going to Buffalo. So far this season, the bay ports had not done any grain business to speak of. It was his opinion that any lowering of rates through Canadian channels would be met by similar reductions on the Buffalo-New York rate.

The question of the establishment of fixed rates was discussed briefly, Mr. Playfair pointing out that to secure that result would necessitate the placing of vessel rates under the Board of Railway Commissioners. As things were at present one or two boats could spoil any arrangement regarding rates. No opinion was expressed by the witness as to the advisability of giving the Board of Railway Commissioners jurisdiction in the matter.

D. W. McLACHLAN AS TO STREAM FLOW AND OPERATION AND
MAINTENANCE CHARGES*(Pages 260 to 263)*

Mr. D. W. McLachlan was recalled on June 6, and asked particularly as to the division of the flow in the international section of the St. Lawrence. He dealt with the flow on the respective sides of the boundary line at various points, which flow varied considerably, but taking the international rapids section as a whole he was of opinion that about 49 per cent of the volume of the flow would be found to be on the Canadian side, and about 51 per cent on the United States side of the stream.

At this hearing, Mr. McLachlan was asked to prepare a statement showing the expense of administration of the present canal system and Great Lakes connecting channels from Montreal up, and the division of the same as between the two countries. He was also asked to provide a similar statement with respect to the recommended scheme of the Joint Board of Engineers presently under consideration. These two statements will be found in detail on pages 262 and 263 of the Committee's Proceedings. Briefly stated, the average annual maintenance and operation costs of the present navigation system—Montreal to Lake Superior—based on a five-year period (1922 to 1926, inclusive) is \$1,918,500, Canada's proportion of which amounts to \$1,374,800 and that of the United States to \$543,700.

The estimated annual maintenance and operating costs of the proposed deep waterway—Montreal to Lake Superior—assuming that the Crysler Island project will be adopted in the International Rapids section, and the Hungry Bay-Melocheville project in the Soulanges section, is given as \$4,147,500. Of this amount, \$2,717,500 is attributable to navigation and \$1,430,000 to power. As to the cost of maintenance and operation of the navigation works, \$2,100,000 would fall to Canada and \$617,500 to the United States, \$1,000,000 of Canada's share being attributable to the Welland Ship canal. These figures do not include the cost of maintenance and operation of the existing lights and other aids to navigation. They do include, however, the cost of maintaining such parts of the existing 14-foot canal system as will still be available for use after the deep waterway is built.

OLIVIER O. LEFEBVRE, CHIEF ENGINEER, QUEBEC STREAMS
COMMISSION*(Pages 263 to 280)*

On June 6th the committee heard Mr. Olivier O. Lefebvre, Chief Engineer of the Quebec Streams Commission, Montreal, who was a member of the Joint Board of Engineers which conducted the engineering investigation into the St. Lawrence project on behalf of the Governments of Canada and of the United States. Mr. Lefebvre's remarks were based on a translation of an address delivered by him in Quebec, May 7, 1928. It developed in the course of the hearing that Mr. Lefebvre had also outlined the deep waterway proposals for the Montreal branch of the Engineering Institute of Canada on a steamship trip taken by the members of the Montreal branch from Montreal to Brockville, and return, passing through those portions of the river where the principal navigation and power works will be located.

In his remarks before the committee, which were largely a reproduction of his Quebec address, Mr. Lefebvre outlined the history of the various St. Lawrence proposals. The falls and rapids on the St. Lawrence had a power potentiality approximating 5,000,000 horse-power, of which 3,000,000 are in the Canadian rapids section and 2,000,000 in the international section, and the engineers had been asked to advise as to the cost of improving the river for navigation alone, and for power alone; what would be the cost of a combined plan of development, and also whether it would be advantageous to carry out a combined project. Mr. Lefebvre pointed out that the St. Lawrence has a drainage basin of about 375,000 square miles at Montreal, a flow which is extraordinarily regular, and in fact, is the best regulated river in the world. At the outlet of lake Ontario, the maximum flow registered was 320,000 second feet, and the minimum flow 180,000 second feet. The ratio between the extreme maximum and extreme minimum was less than 2 to 1. On the St. Maurice the ratio is 25 to 1; and on the Ottawa river, 10 to 1.

Mr. Lefebvre dealt with the ice conditions inherent to a development of the St. Lawrence, where sections of the rapids do not take with ice. This stretch of open water exposed to the cold air forms frazil which, carried along by the current, packs in those portions of the river where the surface is ice-covered. This process of ice formation goes on throughout the entire winter, and leads to winter flooding at Montreal and at Cornwall. To insure the operation, during the winter months, of hydro-electric power houses an ice cover is essential, and to achieve that it was necessary to enlarge the section of the river in the rapids to a point where the velocity of the current would not be more than $2\frac{1}{4}$ feet per second; or, at all events, that the surface of water exposed to the air would be reduced to a point where any frazil formed might be stored in the deep part of the head race, without retarding the regular flow of the river.

Proceeding, Mr. Lefebvre dealt with the items of cost as ascertained by the engineers and set out in their report. He emphasized the fact that public opinion was agreed that there should be no export of power; that indeed was about the only point in connection with the proposals on which Canadian public opinion was in agreement. The estimate of the Wooten-Bowden scheme in 1921 had been \$252,000,000 as compared with \$650,000,000 mentioned in the more recent report. As to that, Mr. Lefebvre explained that the Wooten-Bowden scheme had to do with a development from Montreal to lake Ontario only, and, in addition, dealt only with the development of 1,464,000 horse power in the international section, leaving for future consideration the possible development of power in the Canadian section. The present report dealt with the power possibilities of both the international and the purely Canadian section, and with a scheme of navigation running all the way from Montreal to lake Superior.

In any scheme of development a uniform flow of the St. Lawrence would have to be maintained at all costs. That would require to be guaranteed, and the control of the flow from lake Ontario, therefore, was a matter of prime consideration. It was felt that the plan of development recommended by the Canadian section of the Joint Board of Engineers, though involving an outlay of \$34,000,000 more than the United States single-stage plan, afforded greater security to the port of Montreal and the level of the river below Montreal. Mr. Lefebvre quoted various paragraphs from the engineers' report dealing with the matter of the control of the flow of the river for power and navigation. As to that, the engineers had been asked the definite question—"To what extent may water levels in the St. Lawrence river at and below Montreal, as well as the river and lake levels generally, be affected by the execution of the project?", to which the answer was:—

"The irresponsible operation of the power works proposed by the Board, or indeed any power works, however designed, that develop fully the power resources of any section of the river, would affect injuriously the water levels in the St. Lawrence river at and below Montreal; but it is feasible to operate these works under government supervision in such manner that they will neither lower the summer levels in the lower river nor raise the winter and spring levels. With such control the improvements proposed will have no injurious effect whatever on the water levels of the St. Lawrence at and below Montreal."

Mr. Lefebvre stated that the possibility of regulating the discharge of the Great Lakes with a view to preventing fluctuations had been the subject of a very thorough study, as a result of which the engineers had agreed that no scheme of improvement involving regulating works could be carried out which would warrant the extraordinary expense involved. However, it was the view of the engineers that compensating works in the form of submerged weirs at the outlets of lake Huron and lake Erie would provide remedial measures in a more natural manner at an estimated cost of \$3,100,000.

These works, however, would not provide a remedy for the loss of power in the St. Lawrence due to the Chicago diversion. That was represented by 8,500 second-feet and amounted to 161,000 horse power in the section of the river between Prescott and Montreal.

In discussing the question of freight rates and their possible improvement, Mr. Lefebvre called attention to the importance of the factor of what he called vertical distance. The distance between Fort William and Port Colborne is 850 miles requiring a lockage of 18 to 20 feet at Sault Ste. Marie. The average time required for that lockage in 1925 was 1 hour and 9 minutes; deducting delay incidental to entry and exit the actual lockage consumed 52 minutes. From Port Colborne to Montreal—a distance of 368 miles—the drop to be overcome by canals and locks is 540 feet. That vertical distance was equivalent to a horizontal distance of about 300 miles, taking the average speed of the freighters on the Great Lakes. The rate—3 cents—between Fort William and Port Colborne would not be affected as a result of the proposed improvements. Between Port Colborne and Montreal, the rate worked out at about 6 cents, and most competent authorities believed that a reduction of about 3 cents might be effected by the proposed deep water development. It could only apply to grain tonnage which would be carried mainly by this improved route. On the basis of wheat, that reduction would equal one dollar a ton. The capacity of the projected canal was 24,000,000 tons per year, all classes of freight. Traffic on the Great Lakes in 1926 totalled 121,000,000 tons, which included iron ore from the mines on lake Superior to the harbours on lake Erie, 63,000,000 tons; coal traffic to the west, return traffic, 31,000,000; crushed stone, 14,000,000 tons (used as flux in blast furnaces); grain, 12,000,000 tons. The balance of the traffic was largely made up of package freight. Grain was the only article that might increase the traffic on the Great Lakes and that traffic would probably show a large increase. What package trade might be developed would be problematical. On the other hand, it should be borne in mind that the fixed charges, interest and maintenance of the improved canals would be several million dollars greater than they are to-day, and there are no tolls charged.

Mr. Lefebvre made the following reference to a matter that he considered of prime importance from the Quebec standpoint:—

"Then there is another aspect of the deep waterway project to which attention must be called, and that is the necessity of separating the cost of navigation from the cost of power development. The canals of Canada have been declared to be public works which have been carried out

for the greatest advantage of the country, and their cost is paid by the whole country. Water power must be paid for in the final analysis by the consumer of electric current. Now, the Government is being advised from certain quarters to deviate from this principle and the following proposal is put forward: The St. Lawrence deep waterway may be carried out without entailing any cost to the country in addition to those expenditures which we are committed to such as the Welland canal. Here is the proposal: As an offset to our expenditures for the Welland canal and the deepening of the St. Lawrence below Montreal, the United States would be asked to undertake at their own expense the works projected in the International section of the river for the improvement of navigation and the development of power. Canada would take her share of the completed works including half of the power. As regards the national or Canadian section of the river, the section situated wholly in the province of Quebec, it is submitted that the producers of the hydro-electric power—private interests probably, but the principle would be the same in case of a Government organization—would be prepared to provide the country with improved navigation free of charge in exchange for the privilege of developing the water power, and here you have a completed deep waterway project without any further cost to the Federal treasury.

"It is nevertheless interesting to ponder for a minute and ask oneself who is going to assume the function of the federal treasury, because, after all is said, this improved navigation, the cost of which is estimated at from \$86,000,000 to \$90,000,000, must be paid for by somebody. The canals cannot provide any source of revenue, as they are free. The only source from which these producers of power, or private interests, could derive revenue would be the sale of power. Consequently, it is self-evident that the cost of navigation, which would be added to the normal cost of their power development, would be paid by the consumer of electric current. This method would be extremely unfair to the province of Quebec, which would be called upon to pay in the final analysis the cost of an improved navigation that is designed to benefit, and is demanded by interests outside the limits of that province.

"This proposal is embodied in the report of the National Advisory Committee, as follows:—

"We believe that if a reasonable time were permitted in which to enable the resultant power to be economically absorbed, the development of this national section would be undertaken by private agencies able and willing to finance the entire work, including the necessary canalization, in return for the right to develop power."

"Messrs. Beaudry Leman and the Hon. Adelard Turgeon declined to assent to such a proposal, and it is hoped that the Federal Government will not entertain it."

Hon. Mr. McDougald: "Were you a member of the Advisory Board of Engineers when you made that speech?"

Mr. Lefebvre: "I am yet a member of the Joint Board of Engineers."

Hon. Mr. McDougald: "And were you speaking for yourself in that last paragraph, or for the province, or the Quebec Streams Commission, or the Joint Board of Engineers?"

Mr. Lefebvre: "I was speaking purely as a citizen of the province of Quebec."

Mr. Lefebvre went on to state that what the province of Quebec required was cheap power that would bring in large industries and keep their population at home. The scheme proposed was not calculated to give that result, and to saddle the cost of providing navigation in the Canadian section on the power development of that section would, spread over 3,000,000 horse-power, mean an added cost of \$2.50 per horse-power to the selling price of the power.

In conclusion, Mr. Lefebvre summarized his points, as follows:—

“1. The St. Lawrence can be improved for navigation alone at a cost of \$167,000,000 between lake Ontario and Montreal, and at a cost of \$44,000,000 in the Great Lakes section, for navigation at 25 feet. This is the deep waterway project proper.

“2. The St. Lawrence can be improved for power alone, retaining the present canals, at a cost of about \$533,000,000—whether there be canalization or not, this water power will be developed some day.

“The two proposals are distinct.

“3. It is necessary that a uniform flow be maintained down the river, and every development scheme must be made to provide for the **maintenance of this uniformity.**

“4. We must scrutinize the plans which may be proposed with respect to the development of the International section of the river, as well as the plans which may be proposed in regard to the control of the flow from the Great Lakes.

“5. The cost of canalization must be separated from that incidental to the hydro-electric development—improved navigation should be paid by the country at large and not by the consumer of power.”

In reply to subsequent questioning, Mr. Lefebvre stated that while the Canadian two-stage scheme of development would cost \$34,000,000 more than the United States single-stage scheme, it was a small amount when the greater safety to navigation at Montreal was considered. Slightly less power—probably 100,000 horse-power—would be developed under the Canadian plan.

Senator McDougald asked about the trip from Montreal to Brockville and return in the course of which Mr. Lefebvre had explained the St. Lawrence engineering proposals. Mr. Lefebvre said that that trip was organized by the Montreal branch of the Engineering Institute of Canada. Senator McDougald asked who the president of the Engineering Institute was this year. Mr. Lefebvre replied that it was Mr. Julian C. Smith, vice-president and manager of the Shawinigan Water and Power Company.

Mr. Lefebvre agreed with the other members of the Joint Board of Engineers that the canal works could be placed on the Canadian side at a cost of \$3,500,000 more than the recommended scheme.

(This concludes the digest of the evidence taken by the committee. The evidence in full, as reported by stenographers, will be found in the subjoined Minutes of Evidence.)

MINUTES OF EVIDENCE

WEDNESDAY, 2nd May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, etc., met this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

Mr. D. W. McLACHLAN, Engineer in Charge, St. Lawrence Waterways, Department of Railways and Canals, Ottawa, Ontario, appeared before the Committee and testified as follows:

The CHAIRMAN: Mr. McLachlan, will you take us over the St. Lawrence?

Mr. McLACHLAN: Mr. Chairman, I have read over this statement, and it is quite accurate. Do you wish to put it in as a statement from me?

The CHAIRMAN: It is simply a chronological statement.

Mr. McLACHLAN: It is quite accurate.

The CHAIRMAN: I think it would be of advantage to have it on record.

Mr. McLACHLAN: Perhaps Dr. Skelton would like to read it over.

(Statement of Commissions and Boards to investigate and report, filed with the Clerk of the Committee, reads as follows):

ST. LAWRENCE WATERWAY

COMMISSIONS AND BOARDS TO INVESTIGATE AND REPORT

1909—January 11—Treaty between United States and Britain creating the International Joint Commission.

1920—January 21—The Government of the United States and Canada referred to the International Joint Commission questions relating to the improvement of the St. Lawrence River between Lake Ontario and Montreal. for the purpose of making it navigable for deep-draft vessels, and securing the greatest beneficial use of the water for power.

Each of the Governments designated an Engineer to co-operate in the necessary surveys, Colonel William P. Wotten acting for the United States and the late W. A. Bowden, Chief Engineer, Department of Railways and Canals, for Canada.

1921—June 24—The report of these two Engineers was submitted to the International Joint Commission.

1921—December 19—The International Joint Commission issued a report recommending, among other things,

That the proposed works between Montreal and Lake Ontario be based upon the report of the Engineering Board—(Report of 1921)—but that before any final decision is reached the report of the Board, together with such comments, criticisms and alternative plans as have been filed with the Commission, be referred back to the Board enlarged by other leading members of the engineering profession, to the end that the whole

question be given that further and complete study that its magnitude and importance demand, and that after completion the administrative features of the improvement be carried out as set forth in recommendations 7 and 8 hereof.

1924—March 14—The President of the United States appointed a national Committee of nine members, designated as the St. Lawrence Commission of the United States, having as its chairman Honourable Herbert Hoover, to act as an Advisory Committee to the Government on all questions relating to the improvement of the St. Lawrence river.

1924—April 2—The United States Government designated three engineers as members of the United States section of the Joint Board of Engineers and as advisers to the St. Lawrence Commission of the United States.

1924—May 7—The Government of Canada appointed a similar Advisory Committee of nine members, and for a like purpose, under the chairmanship of the then Minister of Railways and Canals, Honourable Geo. P. Graham.

1924—Following the recommendation made by the International Joint Commission in its report of December 19, 1921, it was agreed by the United States and Canada that a joint Board of Engineers, consisting of six members, three representing Canada and three the United States, be constituted to review the plans then formulated and to report on such additional related matters as might be referred to it.

1924—May 7—The Government of Canada appointed as members of the Canadian section of the Joint Board of Engineers and as advisers of the National Advisory Committee, the three following engineers:—

Mr. D. W. McLachlan, of the Department of Railways and Canals, Ottawa.

Mr. Olivier O. Lefebvre, Chief Engineer, Quebec Streams Commission, of Montreal.

Brig.-General C. H. Mitchell, of Toronto.

1925—The instructions to the Joint Board of Engineers were agreed to by the two Governments on February 4 and March 17, 1925, respectively, and are to be found in detail on pages 4, 5 and 6 of the printed Report of the Joint Board of Engineers, dated July 13, 1927.

Mr. McLACHLAN: I thought, Mr. Chairman, from your letter, the best thing I could do would be to start at the head of the Lakes and go down to the sea, describing the river as it is, and what is proposed to be done with it—pointing out where disagreements exist, if any—and if at any place you wish to interrupt and ask questions, I will try to answer them. I have not prepared any written statement at all in regard to the matter. I thought that as questions arose they would explain themselves.

The CHAIRMAN: Very well.

Mr. McLACHLAN: Then I will start at the upper end and tell you what I can.

Hon. Mr. DANDURAND: At what point do you start?

Mr. McLACHLAN: I was going to start at the head of Lake Superior and run down to the sea. You will notice before you a chart in which the Canadian territory is shown in pink and American territory in yellow. The Great Lakes in the foreground are shown in white. They are also shown in blue in profile. From Lake Superior to Lake Huron there is a drop of about 22 feet; from Lake Huron to Lake Erie a drop of about 8 feet; from Lake Erie to Lake Ontario a drop of about 326 feet, and from Lake Ontario to Montreal a drop of about 222 feet. There is a further drop of about 22 feet from Montreal to the sea, depending upon the flow of the river.

The drop between Lake Superior and Lake Huron is nearly all taken up at the locks at the Soo. There are four locks at the Soo, three on the American side and one on the Canadian. At the locks the drop is about 20 feet and in the river below the locks it is about 1 foot. That slope steepens to about $2\frac{1}{2}$ feet in winter. There is a navigable depth of about 21 feet in channels between Lake Superior and Lake Huron. The straight lines in the profile show where material has been excavated. The length of channel excavated is about 22 miles. Some channels are formed in rock, some in earth. In a number of cases there are two way channels. Where the channels are single, they are 600 feet wide; where they are double, or separated, they are 300 feet wide. The locks and navigation channels were all built before there was any dam across the river at that point. After the channels were excavated a dam was built right across the river. That dam now controls the level of the lake, but it is designed to control it very much as the rock ledge controlled it in nature. It compensates for the diversions made by the power canals on either side of the river.

Hon. Mr. DANDURAND: Where is the dam there?

Mr. McLACHLAN: The dam is right across the river between the Canadian canal and the American canal.

Hon. Mr. MURPHY: What river?

Mr. McLACHLAN: The St. Mary's river. Since it was built it has been operated to raise the general level of Lake Superior about seven inches. It has controlled the outflow from Lake Superior and besides holding up Lake Superior in low flow periods it has lowered the level in Lake Huron and Lake Michigan to a very small extent.

Hon. Mr. COPP: Was that dam built for the purpose of maintaining the height of water?

Mr. McLACHLAN: It was built not to raise the level of Lake Superior above high water levels but to enable the flow in the natural channel to be controlled so the diversions of water made by the power companies on both sides of the river would not lower the level of Lake Superior.

The chart shows the American and Canadian canals—It shows the three locks on the American side and the single lock on the Canadian side. The dam runs from the American canal bank to the Canadian shores right an the rim of the rapids—It is a very shallow dam—it consists of piers built on the floor of the river and gates that drop down almost to the rock surface. On the American side of the river there is a power canal $2\frac{1}{2}$ miles long inland, which carries thirty thousand second feet to a power house about a mile below the present locks. On the Canadian side there is a power canal and a power house which uses about 20,000 c.f.s. These developments were continually being enlarged, units being added, so the water level of Lake Superior began to lower a little and these power companies made application to build compensating works. The best way to operate these was investigated by the International Joint Commission. They gave approval to these works with a rule that was to govern their operation. They were to hold the lake within certain limits: If the water went above a certain level the control boards were to open the gates; if it went below, they were to close them. As a matter of fact, the rule they laid down could not be carried out exactly. They could not, by anything they could do, hold up the level of Lake Superior during the period when flows were very low, because evaporation from the lake was so great; but they did hold it up somewhat as compared with nature.

Hon. Mr. MURPHY: Does the chart show the Livingston channel?

Mr. McLACHLAN: No. The channel improvements for navigation above the Soo are small. Below the Soo the excavation is continuous for a long distance.

Hon. Mr. LYNCH-STANTON: Is there any difficulty in entering our canal from the upper side?

Mr. McLACHLAN: There is some difficulty.

Hon. Mr. LYNCH-STANTON: There was before. Did they remedy that?

Mr. McLACHLAN: No. They have never been able to remedy it very much. There is a cross-current above, and also below due to the power development there. The two new American locks have 24½ feet on their sills at low water. That is above 5 feet more than there in the channel above and below.

Hon. Mr. REID: What is the channel at the present time from Port Arthur to the foot of Lake Huron?

Mr. McLACHLAN: The depths are shown in the plan exhibited. The old Poe lock gives a depth of about 18 feet and the Canadian lock about 18½ feet.

The channels below and above these locks give about 21 feet in earth, and 22 feet in rock, so the boats using these channels now cannot go through the Canadian and old American locks unless they are light and draw less than 18 feet. For this reason nearly all the loaded boats go through the American locks, and our lock passes very few boats down bound. Boats using channels in earth only require a clearance on one foot below the keel.

Hon. Mr. LYNCH-STANTON: Don't they prefer the American channel on account of the current on our side?

Mr. McLACHLAN: No, they prefer the American channels because they are deeper. They can load a foot and a half deeper.

Originally, before the new American locks were built, our lock had a few inches more depth than they had, and our lock used to handle about 60 per cent of the traffic. Our lock used to pass 40,000,000 tons a year. That is more traffic than any other lock in the world passed before. There is a little in what you say in that there is a cross-current above our locks, due to the Canadian power development. But that is not serious.

Hon. Mr. MURPHY: At the lower end of the lock there was an artificial difficulty created, wasn't there, by the overflow of the power canal, and they have to warp the boats in?

Mr. McLACHLAN: That is quite so.

Hon. Mr. MURPHY: That is an artificial difficulty.

Mr. McLACHLAN: That is what I mean. Both these difficulties are artificial.

Hon. Mr. LYNCH-STANTON: You said the construction of these remedial works had affected the fall below the locks. How can it do that?

Mr. McLACHLAN: That is quite a point. It did that is this way: it did that as compared with nature. Suppose you asked me in October of last year, when navigation was interested, to give the effect of Regulation of Lake Superior and on Lake levels generally, my answer would have been that it had raised Lake Superior about half a foot, and lowered these two lakes an inch or two.

Hon. Mr. LYNCH-STANTON: How?

Mr. McLACHLAN: The only way you could determine effects is to tabulate supplies and the amount of water which runs off from month to month each way by rule and by nature. The accumulated results from month to month would give the answer. You will find by regulation Lake Superior would be higher and Lake Huron lower than in nature. The reason for this is that the lakes rise and fall 2½ or 3 feet every year. They rise because it rains in the spring, and they fall because it does not rain much in the fall. When Superior is high we allow a lot of water to flow out probably as much as would flow out in nature, but as soon as the spring floods are past we throttle the flow and keep the water there to keep Lake Superior from going down as much as it ordinarily would.

Hon. Mr. LYNCH-STAUNTON: When it gets over the top why should not the same quantity go over?

Mr. McLACHLAN: If flow is checked at the Soo there must be a reduced supply to hold Huron up in the receding period. There is less water pouring into Huron, and the same amount running out. Therefore the lake must go down faster than in nature.

Hon. Mr. LYNCH-STAUNTON: I don't understand how less pours into them.

Mr. McLACHLAN: Because you close the gates and store more above. If in nature there is a $2\frac{1}{2}$ foot drop between July and November in the lake, and you reduce that to a foot and a half, obviously in those months less water must flow in at the Soo. As a matter of fact, these lakes do not adjust themselves quickly. If Huron had a certain elevation, say at the beginning of July, it would flow at almost the same amount whether it was 2 inches higher or 2 inches lower. The change in the elevation would not change the amount flowing out very much. On the other hand the operation of the rule might require a large change in outflow from lake Superior.

Hon. Mr. MURPHY: Is that Lake Huron?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUNTON: Wasn't the water in 1896 as low as it has been any year?

Mr. McLACHLAN: It was lower in Lake Ontario in 1895 than in 1925, because we raised lands by the Gut dam. You will find that Superior, Huron, and Michigan were lower in 1925 than they have ever been in their history.

Hon. Mr. McMEANS: What is the relative flow coming through the Sault and that taken by Chicago?

Mr. McLACHLAN: There is an average of about 76,000 second feet, at the Soo and about 9,000 going out at Chicago. There is about 181,000 going out through the Lake Huron outlet, about 206,000 through the Niagara, and about 240,000 out of the St. Lawrence. Below the Sault there is the Little Rapids cut. Then the Hay Lake channels, the Neebish channels and the Mud Lake channels. Between Hay Lake and Mud Lake there are two channels to take care of navigation, one is the Middle Neebish and the other is the West Neebish. Both Neebish channels are only 300 feet wide in the rock ports. The rock ports of each of these channels are two miles long. These rock channels were coffer-dammed and excavated in the dry, about twenty years ago. The United States engineers have a project, which I believe has just been approved by Congress, for enlarging the Middle Neebish to 600 feet.

Hon. Mr. LYNCH-STAUNTON: Enlarging what?

Mr. McLACHLAN: They are doing this because they are afraid a boat will get crossways in one of these channels, and then they would only have one 300-foot channel left for navigation which would mean shuttling of traffic and delays. There is a traffic of about 90,000,000 tons a year through this waterway, and currents of three miles an hour are met in both the Neebish channels.

Hon. Mr. BEAUBIEN: What is the compensating work.

Mr. McLACHLAN: The compensating works are just above the C.P. Ry. Bridge. Below the Sault there are in all three channels: there is the West Neebish, and the Middle Neebish, both all American; then there is the Garden River channel, which runs through Lake George and north of Sugar Island. This channel has a depth of about twelve feet. It is not entirely Canadian. The boundary line, as you see, crosses the channel and in some cases between it and the Canadian shore there is only about two feet of water. So we have no all-Canadian channel at the Sault.

Hon. Mr. BEAUBIEN: Those that are used are the two American channels?

Mr. McLACHLAN: Yes. By Treaty we have the use of them. They have to remain open to our ships.

Hon. Mr. LYNCH-STAUTON: You say there is no Canadian channel at the Sault. You mean there is none dug out? Is that the idea?

Mr. McLACHLAN: Yes.

Hon. Mr. MURPHY: None used for navigation purposes.

Mr. McLACHLAN: None used for navigation purposes.

Hon. Mr. LYNCH-STAUTON: But you could have one? We have the water there.

Mr. McLACHLAN: You can do anything with money, yes.

Hon. Mr. LYNCH-STAUTON: But, I mean, the water is there.

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUTON: The boundary line does not hug the shore?

Mr. McLACHLAN: The boundary line almost hugs the shore in some spots, but no doubt you could get between the boundary line and the shore everywhere with a small boat.

Hon. Mr. MURPHY: With vessels of what depth?

Mr. McLACHLAN: With a depth of about two feet now but you could excavate deep channels.

Hon. Mr. McDougald: Mr. McLachlan, would it be practicable to build an all-Canadian channel there at the Sault?

Mr. McLACHLAN: I have never made an estimate of it. I should not think it would be practical.

Hon. Mr. BEAUBIEN: What would be the effect in lowering the water if you brought that two-foot channel down to 24 feet?

Mr. McLACHLAN: It would be very small. The total slope in the river between the foot of the locks and the lake is only one foot now. If you dug another channel you might lower that two or three inches. That is as much as it would be.

Now as to recommendations. Our Board were asked to estimate the cost of a channel 25 feet deep or any other depth that we would recommend. As we could not agree on anything but 25 feet; we gave the cost of excavating a channel between Lake Superior and Lake Huron to that depth.

Hon. Mr. MURPHY: Mr. McLachlan, you were interrupted when you started on your journey from Lake Superior down. I understand you were going to describe the conditions on the Lakes, at the outlets and on the connecting rivers.

Mr. McLACHLAN: That is correct.

Hon. Mr. MURPHY: When you go along would you be kind enough to mention the name of each of the connecting rivers?

Mr. McLACHLAN: Yes. I finished describing the natural conditions at St. Mary's river. I will leave it now and come back later and describe what we propose.

Hon. Mr. MURPHY: That is right. Finish one story and then come back to the other.

Mr. McLACHLAN: I will describe the natural conditions first.

Hon. Mr. WILLLOUGHBY: Go on with the river.

Mr. McLACHLAN: Between Lake Huron and Lake Erie, as you all know, we have the St. Clair river, forty miles long, Lake St. Clair, about twenty miles across, and the Detroit river below that, about thirty miles long. We have a fall of five feet between Lake Huron and Lake St. Clair, and a fall of about three feet between Lake St. Clair and Lake Erie.

Hon. Mr. COPP: Eight feet altogether.

Mr. McLACHLAN: I have shown the channels in profile. The slope is not very clearly marked. It is drawn at the same scale as the St. Mary's river, so you will be able to size it up with your eye. From Lake Huron down to Lake St. Clair there are not very many places where any dredging has to be done. At the foot of Lake Huron there is about two and one half miles of excavation, and below there are quite a few places where little spots have been taken off. Then the whole width of Lake St. Clair had to be dredged. The flat horizontal line shows its extent.

Hon. Mr. DANDURAND: What is the depth now?

Mr. McLACHLAN: Twenty feet at the upper end, and 21.8 at the lower end. It is soft mud, and the boats scrape the centre of the channel deeper. It is 21 feet in the middle of the channel, and on the edge it shoals up a bit. Below Lake St. Clair the Detroit river is deeper than required to Fighting Island. Along Fighting Island, there is some artificial channel and opposite Amherstburg below there are two channels, one called the Livingstone and the other the Amherstburg.

Right Hon. Mr. GRAHAM: The channel is on the Canadian side?

Mr. McLACHLAN: The channel is on the Canadian side. I will give you some facts with reference to what we have covered. In that Sault river 22 miles of improved channel and 1.7 miles of canal are used in going one way.

Hon. Mr. MURPHY: That is the St. Mary's river?

Mr. McLACHLAN: That is the St. Mary's river. In the St. Clair river there was 9.9 miles of artificial channel.

Hon. Mr. LYNCH-STAUNTON: That is, Livingstone channel?

Mr. McLACHLAN: No; that is in the St. Clair river at the outlet of Lake Huron at Port Huron—at Stag Island and other places. The river from Port Huron down to Lake St. Clair is generally deep enough for 25 feet. It is quite a strait and runs through a clay country. It is a very nice piece of water to navigate. There is a gradual movement of gravel down stream from Lake Huron.

The dredging of gravel in this river here has flattened its slope quite seriously in the last twenty-five years. We are not in exact agreement with the United States engineers as to the amount this has lowered Lake Huron or as to how much we have contributed to it and how much they have contributed to it. The total flattening of that river in the last twenty-five years appears to be about eight-tenths of a foot.

Hon. Mr. LYNCH-STAUNTON: Increased flow of the gravel in the last twenty-five years?

Mr. McLACHLAN: The removal of gravel.

Hon. Mr. LYNCH-STAUNTON: It is coming down into the river?

Mr. McLACHLAN: The gravel came down into the river. And people dug it out.

Mr. McLACHLAN: The Livingstone channel is twelve miles long and is 450 feet wide in part and 800 ft. wide in part. The Amherstburg channel is thirteen miles long and six hundred feet wide, one is used up and the other down. Both these channels are in Canada for a length of six miles.

Hon. Mr. LYNCH-STAUNTON: Where is Lime Kiln Crossing?

Mr. McLACHLAN: It is opposite the upper end of the Amherstburg channel.

Right Hon. Mr. GRAHAM: Was that excavated by the United States?

Mr. McLACHLAN: All the work I have described, between Lake Huron and Lake Erie, has been done by the American Government.

Right Hon. Mr. GRAHAM: On our side?

Mr. McLACHLAN: Not all of it on our side, but the bulk of it is on our side. The channel comes across to our side of the line for a couple of miles above Stony Island, then it crosses back to their side again, and then it crosses again to our side and keeps on our side until it almost reaches Lake Erie.

Right Hon. Mr. GRAHAM: There was a good deal of rock?

Mr. McLACHLAN: Yes. It was cofferdammed at the upper end and at the lower end, and banks were built on both sides and the whole area was pumped out and the rock excavated in the dry.

Hon. Mr. MURPHY: When was that done?

Mr. McLACHLAN: It was started about 1908 and finished about 1914.

Hon. Mr. MURPHY: Did Canada bear any part of the cost?

Mr. McLACHLAN: No part whatever.

Hon. Mr. LYNCH-STANTON: They paid for it all?

Mr. McLACHLAN: They paid for it all. A few years ago they widened it. It was first built 300 feet wide, then it was widened to 450 feet. Now it is 450 feet wide at the narrowest part. It is the downbound channel.

Hon. Mr. BEAUBIEN: All that part of the channel is on our side?

Mr. McLACHLAN: No, not all. The part that was cofferdammed was on their side, but all the submarine work that was done by open dredging was on our side of the line. It was done by our consent, I am sure. I remember they asked about it.

Hon. Mr. McDUGALD: Could we get an all-Canadian route there?

Mr. McLACHLAN: You could get an all-Canadian channel much more easily in the Detroit and St. Clair rivers than you could—

Hon. Mr. BEAUBIEN: At the Sault?

Mr. McLACHLAN: At the Sault. I do not see any insuperable difficulty at all in the Detroit River. But I have never considered it from that point of view. There are 9.9 miles of artificial channel in the St. Clair river between Lake Huron and Lake St. Clair. There are 14.87 in Lake St. Clair, and there are 16.25 in the Detroit river between the outlet of Lake St. Clair and Lake Erie on the downbound journey.

Hon. Mr. LYNCH-STANTON: And the channel is what depth down through there?

Mr. McLACHLAN: The channel is 21 feet in earth and 22 feet in rock at what they call standard low water. It is shown in this diagram on the wall. It is found that boats with tows drag their lines in rock parts and lift up rocks; so they always put rock grade down a foot below the earth. I will not discuss that further now.

Hon. Mr. BEAUBIEN: Is there any understanding between the two countries as to the expenditure in maintaining those channels?

Mr. McLACHLAN: No. The American Government maintain it all, even supplying the lighthouse keepers who have to be on the Canadian side.

Hon. Mr. BEAUBIEN: Is that only between Lake Erie and Lake Huron?

Mr. McLACHLAN: Oh, no; that applies to the St. Mary's river as well. There are some spots in the St. Mary's river where lighthouses are on our side also.

Hon. Mr. BEAUBIEN: All maintained by the American Government?

Mr. McLACHLAN: All maintained by the American Government, including lighthouse keepers. There was some little fuss in the newspapers about two years ago, due to some Customs Officers trying to collect Customs revenue on, I

think, supplies sent the lighthouse keeper by the American Government. I do not remember much about it. You have probably seen it in the newspapers. It was all straightened out anyway.

Hon. Mr. BEAUBIEN: Any trouble at all in the St. Clair river?

Mr. McLACHLAN: In the St. Clair river? The boundary is up and down the river.

Hon. Mr. BEAUBIEN: From Lake Huron to Lake Ontario?

Mr. McLACHLAN: From Huron to Ontario the channel is partly on the American side and partly on the Canadian, as I have explained.

Hon. Mr. BEAUBIEN: What is the length of the American side?

Mr. McLACHLAN: Well, I could not tell you that.

Hon. Mr. BEAUBIEN: Half and half?

Mr. McLACHLAN: All the work through Lake St. Clair is on the American side, and all the work at the outlet of Lake Huron is on the American side. I think the Livingstone channel and the Amherstburg channel are the only extensive works that are on the Canadian side. I would say, about 80 per cent of the work between Huron and Erie are on the American side.

Hon. Mr. BEAUBIEN: Any trouble there at all between the two countries?

Mr. McLACHLAN: No, there is no trouble that I know of.

Hon. Mr. BEAUBIEN: Have we suffered very much from the lowering of the water within the last two years, since water has been used for the Chicago drainage?

Mr. McLACHLAN: We have lost about six inches, due to the Chicago diversion. Our report gives you a tabulation showing 1.15 feet drop in Lake Huron due to all causes. There is about six inches loss of level in Lake Huron, and about six inches loss in Lake Erie, due to the Chicago diversion. There has been a loss of nine inches in level in lake Huron due to recent gravel dredging, and about three inches due to channel enlargement over twenty years ago.

Hon. Mr. MURPHY: When you say "due to gravel dredging," Mr. McLachlan, you mean gravel dredged by private parties and removed for their own use?

Mr. McLACHLAN: Yes, that is it. Of course there is scour too. This may come from winter jams scouring out the clay and enlarging the river after the gravel is removed.

Right Hon. Mr. GRAHAM: It changes the current a bit?

Mr. McLACHLAN: Yes. Anyway there is a reduction in slope of over a foot between Huron and Erie, and there has also been a general drop in both lakes, due to the Chicago diversion, of about six inches.

Between Lake Erie and Lake Ontario, as you know we have a drop of 326 feet. Between the outlet of Lake Erie and the brink of the falls, or the Chippawa pool, just above the falls, there is a drop of about ten feet. Half of that five feet occurs right opposite Buffalo. The remaining part of the river is flat. From this chart you will see that the Niagara river flows past Buffalo and then down to Niagara Falls and into Lake Ontario. The Welland canal cuts across the peninsula about twenty miles west.

Hon. Mr. MURPHY: Where is the Chippawa river?

Mr. McLACHLAN: The Chippawa river comes into the Niagara river above the falls twenty miles below Buffalo.

Hon. Mr. MURPHY: That is, it used to come in there. It runs out now.

Mr. McLACHLAN: It runs out now. Lake Erie has suffered loss of level due to the Chicago diversion, because water has been diverted from its outlet.

Right Hon. Mr. GRAHAM: Lake Erie is a comparatively shallow lake.

Mr. McLACHLAN: A very shallow lake, yes. Down below Buffalo the river divides at Grand Island. The Americans have carried 20 foot navigation to the easterly channel by the Black Rock canal, which is built along the shore for some miles. Tonawanda is reached by this improvement. There is a lock at Buffalo; it is 65 feet wide and 20 feet deep, and 650 feet long. The old Erie canal originally started at Buffalo and ran down along the bank of the river and then struck off across the country to New York.

Hon. Mr. MURPHY: Via Utica.

Mr. McLACHLAN: Via Utica. When the Erie canal was started in 1908, the Black Rock canal saved the extension of the barge canal to Buffalo; they terminated it at Tonawanda and locked into the river there, where they joined the Black Rock channel.

Right Hon. Mr. GRAHAM: What draft has that Erie canal?

Mr. McLACHLAN: It was built for 12 feet, but they have never been able to maintain it. I suppose it is 11 feet.

Right Hon. Mr. GRAHAM: That would be the maximum?

Mr. McLACHLAN: Yes, the maximum.

Hon. Mr. MURPHY: That is the new Erie?

Mr. McLACHLAN: The new Erie; the barge canal, as they call it.

Right Hon. Mr. GRAHAM: In New York State.

Mr. McLACHLAN: The Welland canal starts from Lake Erie, 20 miles west of the Niagara river, crosses the Chippawa or Welland river, which is 10 feet below the level of Lake Erie, goes on through the Deep Cut to Allanburg and Thorold, and then down the escarpment and on to Lake Ontario.

Right Hon. Mr. GRAHAM: There is another point. You have heard a great deal of discussion about the grain going to Buffalo from Port Colborne, at which Mr. McLachlan was pointing. That little stretch from Port Colborne to Buffalo is a part about which there has been a great deal of discussion, with regard to our grain. As a matter of fact quite a lot of our grain goes to Buffalo, is reloaded and comes back to Port Colborne and goes down through the Welland canal and on to Montreal.

Mr. McLACHLAN: A great many of our boats come up the Welland canal, go over to Buffalo, get loaded there, turn around and come back and go down the canals to Montreal.

Hon. Mr. MURPHY: What is the name of the lower end?

Mr. McLACHLAN: Port Dalhousie was the old port of exit. Originally the Welland Canal was built up a creek valley to Thorold and then to Port Robinson. For a few years they used the Chippawa river down to the Niagara river, and then up the river and through the rapids to Buffalo or into Lake Erie. That did not work very well, and our government soon tapped the Grand River and built a feeder canal down to Welland and created a high level canal from Lake Erie to Port Robinson and Thorold. The water level in this canal stood eight feet above the level of Lake Erie. At that time the water was used for locking both ways into Lake Erie and Lake Ontario. That was the situation at Confederation. Around 1880 they decided to deepen this whole summit level of the canal from Lake Erie clear to near Thorold and draw water directly from Lake Erie. That was done. Then some years afterwards, our government decided to deepen the 9 foot canals to 14 feet. The summit level of the old Welland Canal was deepened to 14 feet, in connection with this enlargement, but north of Thorold the old canal was not used. Instead of

coming up the crooked river all through St. Catharines, Merriton and Thorold the route struck off on the ridge near Thorold and wound around the hill, developing distance and using lock after lock of 14 feet lift, until the foot of the hill was reached. The route then struck across country and entered the 15 mile creek just a little above the lock at Port Dalhousie. That was the 14 foot enlargement which was completed about 1890. In 1913 along came the Welland Ship canal, and in the same way it struck off from Lake Erie at Port Colborne. It is 27 feet in rock and 25 feet in earth all the way from Port Colborne to Thorold.

Hon. Mr. DANDURAND: On the very site of the old canal?

Mr. McLACHLAN: Not exactly. Whenever there was rock the old canal line was avoided. This was done so as to excavate it in the dry. Wherever there was earth they tried to follow the old canal. The route came into Port Colborne on the line of the old canal, but as soon as it entered the town it turned off so it could be built more cheaply. In the earth section from Humberstone to below Welland the routes follow the old canal exactly. From Welland to Port Robinson a new route was followed simply because better alignment was secured. The designers did not want to take the bend of the old canal. From the deep cut to Allanburg the routes follow the old canal. From Allanburg clear to the lake Ontario it follows a new route, but it does cross the old canal in two places above Thorold and one below.

Hon. Mr. LYNCH-STAUNTON: Where is it coming down the mountain?

Mr. McLACHLAN: The lake level is carried through to Thorold. I won't say the lake level; a guard lock is placed at Humberstone that takes care of fluctuations in Lake Erie and does not let them go north at all. The boats that go through the guard lock will have a lift which will vary with the level of the lake. The level of Lake Erie at the low period is practically carried through to Thorold. There is one lock at Thorold of 47 feet lift.

Hon. Mr. LYNCH-STAUNTON: Is that the first lock?

Mr. McLACHLAN: It is the first real descending lock. The lift is 47 feet, but in order to operate it safely and to see that no damage would ever be done if a gate is carried away, a guard gate above will be opened and closed behind boats to prevent anything serious happening.

Hon. Mr. MURPHY: When you say, 47 feet, you mean a drop of 47 feet?

Mr. McLACHLAN: Yes! A drop of 47 feet in one lock. Then north of Thorold we have three locks with 47 feet drop in each of them. At this point the escarpment dropped off so rapidly locks could not be separated. We had to arrange three together, and in order to maintain capacity we had to twin them—that is, put them side by side in pairs—boats going down on one side and boats going up the other side. We had to adjust the lock to the steep hill they were on, and we had to build twice as many locks as we would ordinarily build because they had to be together. Between the flight locks and Lake Ontario three locks are placed some miles apart. There are seven lift-locks between lakes Erie and Ontario.

Hon. Mr. DANDURAND: What is the distance of the drop?

Mr. McLACHLAN: Three hundred and twenty-six feet in seven locks. The old canal had 26 locks. There is a siphon culvert in the canal, which passes the Welland river under the canal. It is at Welland. It cost a large sum of money.

Hon. Mr. MURPHY: Has there been any power developed in consequence of the construction of the new canal?

Mr. McLACHLAN: No. It is proposed to develop the flow at one lock to operate the canal.

Hon. Mr. MURPHY: There was power in the old canal?

Mr. McLACHLAN: The old canal has quite a power history. Originally this canal drew water from the Grand river, and of course there was only 100 c.f.s. to do anything with, but even with that the people of that time built a lot of little artificial canals and head races through St. Catharines, Thorold and Merritton to make use of it. It was sometimes a little more than 100 c.f.s. and they made use of what there was. When they tapped Lake Erie and got some more water, they kept on adding to the mill-races and tail-races and down this 326-foot drop from Thorold to Port Dalhousie along the old creek valley. About twenty-five years ago a power development was built at the Decew Falls where 260 feet head was utilized. They tapped the old canal at Allanburg and they got a lease from the Government for about 1,000 c.f.s. of water. The same water was utilized at two points below Decew Falls, one at Port Dalhousie and the other at St. Catharines. That was the situation at the time of the Treaty of 1909 entered into. They had a lease of the right to use 1,040 second feet, and in addition all the old power houses that were built along the old canal in Merritton and St. Catharines had the right to use 760 cubic feet per second, making in all about 1,800 c.f.s., which I think most interpretations of the Treaty will admit was assented to by the United States forever as a diversion of power, because it was an existing use. During the war the power people were allowed to use an old weir. They are using it still.

Hon. Mr. MURPHY: Who is doing that?

Mr. McLACHLAN: The Dominion Power and Transmission Company.

Hon. Mr. DANDURAND: All that diversion of water is simply a temporary one; it all flows into Ontario.

Mr. McLACHLAN: Oh, yes, it all flows into Lake Ontario.

Hon. Mr. LYNCH-STAUNTON: Do you say there is a power development below the Decew Falls?

Mr. McLACHLAN: There are two of them.

Hon. Mr. LYNCH-STAUNTON: Whose are they?

Mr. McLACHLAN: One is at Port Dalhousie and one is a small head at Wellandvale.

Hon. Mr. LYNCH-STAUNTON: Yes, I know that.

Hon. Mr. BEAUBIEN: Is that work all finished?

Mr. McLACHLAN: The canal, not quite. It is nearly finished from Lake Ontario up to Port Robinson. Section four is not finished yet. There is really not much to be done. The lock-gates and the bridges are not very far advanced.

Hon. Mr. BEAUBIEN: How much time will it take?

Mr. McLACHLAN: It will not take long. It depends on how much you appropriate. If you appropriate all the money they want, they can finish it in a year or two. I might explain that in the canal they use a certain amount of power. They need twice as much water for navigation in twin locks as they need with single locks. If they use 2,000 second feet at flight locks 1,000 second feet will spill over without being used at the single locks. We think we have a right to develop 1,000 second feet on each of these individual locks, and use it for operating the bridges and gates, without any reference to anybody else.

Hon. Mr. LYNCH-STAUNTON: Can't you operate those gates from one power-house?

Mr. McLACHLAN: Yes, you can do that.

Hon. Mr. LYNCH-STAUNTON: You will have one power-house at one gate, and the power will be used for all the gates. Is that the idea?

Mr. McLACHLAN: Yes, that is the idea. We could develop at four points, but one is I believe enough to operate the whole canal.

Hon. Mr. LYNCH-STAUTON: I saw a statement the other day by a lake captain that the canal could be traversed in nine hours, but he was questioning whether two of those great vessels could pass in that canal.

Mr. McLACHLAN: They can pass, all right. Of course there will be difficulty with those big boats in crossing a country like that. You see, that canal runs north and south and there is a lot of east and west wind, and if the boats are light, their bows will be away up in the air, and they may get wind-bound sometimes. They have a scheme for meeting that difficulty in a few of the exposed spots. They propose planting trees. I do not think they will have any difficulty in locks, because they have continuous walls to slide along. It is the more exposed spots, where the canal is high up in the air and the country is open, that difficulty will be found. From Lake Ontario down to Kingston the lake is quite open. From Kingston down to Prescott some obstructions are met. The channels are quite wide and deep from Lake Ontario to about Clayton or Gananoque. Below channels become very irregular, and run through deep granite gorges. To get a practical navigation channel at low cost we are forced on the American side for about two-thirds of the distance between above points.

Hon. Mr. MURPHY: You take Kingston as a starting point in the river?

Mr. McLACHLAN: Yes, from Kingston to Clayton on the American side we have no difficulty. Clayton is opposite Gananoque. Below that we have trouble. A practical channel on the Canadian side will cost \$11,000,000 or one on the American side would cost about three-quarters of a million; that is for 25 feet.

Hon. Mr. LYNCH-STAUTON: Between what points?

Mr. McLACHLAN: Between Clayton and the cross-over light.

Hon. Mr. DANDURAND: There are two channels there?

Mr. McLACHLAN: There are two possible channels. A very crooked one on the Canadian side, and a comparatively straight one on the U.S. side.

Hon. Mr. DANDURAND: Which is most used?

Mr. McLACHLAN: The one on the American side is used exclusively.

Hon. Mr. BEAUBIEN: For what length?

Mr. McLACHLAN: For about forty miles.

Hon. Mr. LYNCH-STAUTON: But you do not go out of the river to make that?

Mr. McLACHLAN: No. The whole drop in water level from Kingston to Prescott is about a foot. The water flows through the American channel at a velocity of two or three feet a second, in fact, less than two feet a second in the upper parts, but it rises to three at Alexandria Bay, and it is quiet further on; if a few spots are taken off it will give a 450-foot channel through to Prescott. Further down near Brockville the cheapest place to put the channel is on the Canadian side. If you place it on the American side it would cost a large amount of money.

Hon. Mr. BEAUBIEN: Where is that?

Mr. McLACHLAN: Through the Brockville narrows there is no natural channel on the American side, and if you place the channel there it would cost a fortune. The channel between Lake Ontario and Prescott must be on the American side for about two-thirds of its length, and must be on the Canadian side for the other third if the most economical route is to be followed.

Hon. Mr. BEAUBIEN: Do you stay on the Canadian side near Brockville?

Mr. McLACHLAN: Yes.

Hon. Mr. DANDURAND: You are speaking of Kingston and Brockville?

Mr. McLACHLAN: Yes; it is going to be difficult navigation, and it is most difficult to know just what to do in this section.

Hon. Mr. MURPHY: It is the most difficult now?

Mr. McLACHLAN: It is the most difficult now.

Hon. Mr. DANDURAND: What is the mileage used for navigation purposes just now on the American side, and what is it on the Canadian side?

Mr. McLACHLAN: I would say 40 miles on the American side and 20 on the Canadian. I am just guessing for the American, but I think it is pretty close.

Hon. Mr. BEAUBIEN: What is the drop there?

Mr. McLACHLAN: Just a foot. It is easy enough to make the gorge at Alexandria Bay wide enough, say 450 feet wide, but it is 150 or 200 feet deep, and the floor of the river is solid rock, so if a boat going down drops its anchor it will not stop at all. You cannot drop your anchor and stop. My personal view is that if we want the big lake boats to go down we will have to make the channel 600 feet wide when currents are over two feet per second.

Hon. Mr. LYNCH-STANTON: What occasion would there be for them to drop their anchor there?

Mr. McLACHLAN: Supposing one big boat meets another, and fog comes on, they will be afraid to meet one another for fear they would hit. If they do not drop their anchor and stop, they will go bang into one another, so I think the channel should be 600 feet wide.

Hon. Mr. LYNCH-STANTON: The two channels?

Mr. McLACHLAN: No, but so that a boat can turn around if it did drop its anchor, just let itself swing, and as long as the bow and stern do not hit each side of the channel, it will be all right.

Hon. Mr. LYNCH-STANTON: You say the channel is 400 feet now?

Mr. McLACHLAN: I think the channel is about 350 feet now.

Hon. Mr. LYNCH-STANTON: Why cannot they make two lines, up and down?

Mr. McLACHLAN: Because the granite walls on either side would cost too much to remove.

Hon. Mr. LYNCH-STANTON: I mean two lines like the ocean lines.

Mr. McLACHLAN: You could not make a boat stay on its own side of an open channel; I was a member of a board who reported on this matter from another point of view—the report is not made public—whether terminals should be at Gananoque or Kingston or Prescott, and after much study we came to the conclusion that channels should be 600 feet wide, where there was a considerable current, over 2 feet a second.

Hon. Mr. LYNCH-STANTON: What does that mean in miles?

Mr. McLACHLAN: Three feet per second means about 2 miles an hour.

Hon. Mr. BEAUBIEN: They are using that channel now?

Mr. McLACHLAN: Yes.

Hon. Mr. BEAUBIEN: They have a great many accidents?

Mr. McLACHLAN: They have quite a number of accidents near cross-over light. One-third of the damage done on the St. Lawrence is believed to be done in that territory.

Rt. Hon. Mr. GRAHAM: They run aground.

Mr. McLACHLAN: Yes, they run aground in foggy light.

Hon. Mr. BEAUBIEN: That must increase their insurance?

Mr. McLACHLAN: Yes. Even in this report of ours you will see that we mentioned something in addition to what we show in estimates. We mention the fact that cribs along the places where excavation is to be done may be required. Some of us wanted to put those things in the estimates, but our American members held to the view that they might not prove to be necessary and as they could be built at any time without extra cost they should be left out.

Hon. Mr. LYNCH-STAUNTON: It should not be shown to bluff the people.

Mr. McLACHLAN: It should not be shown until it is demanded. That is, do your excavations, and if the navigation people want you to line the rock walls with cribs, do it then. That is what we agreed to.

Hon. Mr. LYNCH-STAUNTON: It would cost a lot of money to line with cribs.

Mr. McLACHLAN: About \$700,000. To get a 600-foot channel at Alexandria Bay and in Brockville Narrows, with cribs along one side, will cost about \$4,000,000, but I believe we will have to spend it in this stretch before we are through.

Hon. Mr. HUGHES: Do you say that ships passing up and down the channel would not pass each other according to regulations on the proper side?

Mr. McLACHLAN: You cannot enforce rules. Of course there are rules. They are supposed to keep to their right side, and show their lights and all that sort of stuff, but if a fog comes on quickly and one boat is meeting another, and the boat coming down cannot stop, and the boat going up does not stop—though she could if she wants to—what are you going to do?

Hon. Mr. HUGHES: That lane has been mentioned.

Mr. McLACHLAN: You cannot hold buoys in 200 feet of water, because they would swing too much; they would be near one side one minute and near the other the next. I have discussed that with all kinds of navigation people, and I believe you have to provide a 600-foot channel where currents are two miles per hour.

Hon. Mr. McDUGALD: You stated that was the most difficult part of the whole channel to navigate. You mean at the present time, under present conditions?

Mr. McLACHLAN: It causes us more concern as engineers than any other part of the river. We do not know exactly how to deal with it.

Hon. Mr. McDUGALD: So you think that would be the most serious stretch for navigation?

Mr. McLACHLAN: Yes, from an insurance point of view.

Hon. Mr. McDUGALD: Do you think your recommendations would overcome that?

Mr. McLACHLAN: Yes, I think they will.

Hon. Mr. McDUGALD: And that it would be worth while doing that?

Mr. McLACHLAN: Yes.

A map shows the whole territory from Prescott down to Lake St. Francis. The present canals, as you know, run along the north side of the river from Prescott to Cornwall; sometimes navigation is in the river, sometimes on land. An old profile gotten up years ago shows the present line of navigation.

Hon. Mr. LYNCH-STAUNTON: Where is that point?

Mr. McLACHLAN: Johnstown, below Prescott, is at the head of the section; Cornwall, at the head of Lake St. Francis, is at its foot.

Right Hon. Mr. GRAHAM: We who live there know all about the location. Dr. Reid in his speech talked about "Cornwall east", and he was asked by

members why we stick in to Cornwall. That is because it is about the terminus of the section.

The CHAIRMAN: Would it be convenient to put on record the substance of the divisions as you have them in the report?

Mr. McLACHLAN: Yes. We have five sections.

(Extract from the report of the Joint Board of Engineers)

DESCRIPTION

"1. The Thousand Islands Section (Fifth Division of the Report of 1921), embracing the deep, lake-like reaches of the river, 67 miles in length, from lake Ontario to the first swift water at Chimney Point, 3 miles downstream from Ogdensburg, N.Y., and Prescott, Ont.

"2. The International Rapids Section (Fourth Division of the Report of 1921), embracing the 48 miles of rapids and swift water between Chimney Point and the head of lake St. Francis.

"3. The Lake St. Francis Section (Third Division of the Report of 1921), extending 26 miles through that lake to the end of deep water at its foot.

"4. The Soulanges Section (Second Division of the Report of 1921), embracing the 18 miles of rapids and shoal water from lake St. Francis to lake St. Louis.

"5. The Lachine Section (First Division of the Report of 1921), embracing lake St. Louis and the rapids and shoals from this lake to Montreal Harbour, a length of 23 miles.

"108. The first two sections lie along the international boundary, between the province of Ontario and the state of New York. The remaining three lie in the province of Quebec. The improvement of the Thousand Islands Section and of the Lake St. Francis Section is solely a question of excavating channels for navigation. The other three sections can be improved for power in addition to navigation."

Right Hon. Mr. GRAHAM: What forms the International Section?

Mr. McLACHLAN: The International Rapids Section includes the whole territory between Chimney Point or Johnstown, which is below Prescott, and Cornwall. It includes a drop in the river of about 91 feet, and takes in the Galops canal, the Rapide Plat canal, the Farran's Point canal, and the Cornwall canal.

Right Hon. Mr. GRAHAM: That is where you are going to carry on work. But the International Section reaches to Kingston.

Mr. McLACHLAN: We give the river above Johnstown the name of the Thousand Islands Section.

Right Hon. Mr. GRAHAM: It is part of the International Section of the river?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STANTON: But it is not called the International Section for power purposes?

Mr. McLACHLAN: I should have said the International Rapids Section. The International Rapids Section is shown on a large scale on two diagrams. Leaving the river at Johnstown a boat goes through the north channel, a river enlargement; it then goes through the Galops canal, which is about 7 miles long and has a drop of about 15 feet from top to bottom.

Hon. Mr. REID: Excuse me. You only go through one mile going down, and through 7 miles coming up.

Mr. McLACHLAN: Yes, going down only one mile of canal and one lock is used. The lock drops 6 feet. In the Galops canal you go through 7 miles coming up, and one mile going down. You use two locks coming up, and one going down. Below Iroquois the open river is navigated for about $3\frac{1}{2}$ miles both up and down. The drop is about $3\frac{1}{2}$ feet.

Hon. Mr. DANDURAND: Will you state on which side of the International boundary that lies?

Mr. McLACHLAN: All canals in this section are on the Canadian side. From above the Rapide Plat to below Morrisburg there is a canal $3\frac{1}{2}$ miles long called the Rapide Plat. It is a French name.

Hon. Mr. DANDURAND: That is the flat rapid.

Mr. McLACHLAN: It overcomes a drop of $11\frac{1}{2}$ feet. From Morrisburg a boat now navigates the open river both up and down for $9\frac{1}{2}$ miles to Farran's Point, and going downstream it does not go into the canal, but coming up it goes through a canal about a mile and a quarter long, called the Farran's Point canal. It overcomes a lift of about 4 feet. From Farran's Point to Dickenson Landing a boat goes through 5 miles of open river. There it goes into a canal called the Cornwall canal, and proceeds 11 miles through the canal, re-entering the river just below Cornwall. This canal is all on the Canadian side. The drop is about 48 feet in that canal. That canal carries a boat around the Long Sault rapids. It has six locks, three are in Cornwall, and three are above. One is a guard lock at the head of the canal, one is at Mille Roches, and the others are below. All these canals were built by Canada and have been utilized by Americans and Canadians. There has been no toll charges since about 1903. There are no canals on the American side. About a century ago there was a little lock at Waddington, on the American side. Between Cornwall and St. Regis, three miles, the fall in the river is about 8 inches.

Hon. Mr. BEAUBIEN: What is the total length of that section.

Mr. McLACHLAN: About 50 miles.

Hon. Mr. BEAUBIEN: And the money in capital and interest has been paid for?

Mr. McLACHLAN: Paid for by Canada all the time. The fall across the lake St. Francis is about 6 inches. Lake St. Francis between St. Regis and Coteau is a stretch of water about 28 miles long, all in Canadian territory, with a drop of about 6 inches. The level of that lake is about a foot above its natural level. It was raised back in 1850 by a couple of dams at the foot of the lake. To secure 25 or 27 foot navigation there are just a few points to be removed, and the points are all soft material. The property around the lake is all very low and flat, and we cannot raise the level, and all the estimates are based on keeping the present below high water levels. The shores of the lake are all in Canadian territory except at the upper end. That is, the International boundary, following the 49th parallel of latitude, leaves the river at St. Regis. If you change the level of the lake you would raise it at the upper end for a very short distance along the U.S. shore, otherwise we could do whatever we wished without reference to them.

Hon. Mr. REID: At the upper end the land is very high.

Mr. McLACHLAN: Yes.

Hon. Mr. REID: So you would not destroy any property there.

Mr. McLACHLAN: That is practically true. The south side is very low east of the boundary. Between Lake St. Francis and Lake St. Louis there is a fall of 82 feet in 14 miles. The country on the south side of the river is very flat, and, in fact, it is not very high on the north side. It is marine clay

country intersected by a few ridges of rock and hardpan. The improvement of that section is very simple from every point of view. The 82-foot fall occurs in this way: there is about 20 feet fall in the Coteau Rapids, then there is smooth water, then a 32-foot fall, and smooth water, and again a 20-foot fall. At present navigation passes these rapids by a side canal running all the way from the foot of Lake St. Francis to the head of Lake St. Louis on the north side. It has a guard lock at the upper end, and four locks at its foot. That canal was built between 1890 and 1900. On the south side we had a canal called the Beauharnois canal, it passes inland all the way between lakes. It was built in 1844, and was in use at Confederation. It was abandoned for navigation generally in 1901 and finally in 1910.

Right Hon. Mr. GRAHAM: That is where the power is being developed now?

Mr. McLACHLAN: Yes. 28,000 horse-power is developed at St. Timothee. The Canadian Light and Power Company secured the lease of that canal, or the works on it, from the federal government in 1910.

Right Hon. Mr. GRAHAM: In engineering language you say you have a fall here. What are these falls?

Mr. McLACHLAN: Well, there is the Coteau Rapids, with a fall of 20 feet in about 3 miles; the Cedar Rapids with a fall of about 32 feet in about 2 miles; then below that there is a fall of 7 feet in about 3 miles, and another fall of 20 feet in another couple of miles.

Right Hon. Mr. GRAHAM: That is the Lachine?

Mr. McLACHLAN: First there is the Coteau Rapids, then the Cedar Rapids, then the Split Rock Rapids, and the fourth is the Cascades.

Hon. Mr. BEAUBIEN: What is the depth of the Soulanges canal?

Mr. McLACHLAN: Fourteen feet on the sills, and 15 feet in the reaches at low water. The old Beauharnois canal was 9 feet. Before it was built there were some short canals along the north side of the river, all these were built by the Government of that time, the first in 1779 and others in 1817. They were all built in very early days, just for bateaux—very small boats.

Quite a large town called Valleyfield, with 10,000 people, is built on the south side of Grand island.

Hon. Mr. LYNCH-STANTON: De Salaberry Island.

Mr. McLACHLAN: A dam was built across the channel south of Grand Island, de Salaberry, at the time this Beauharnois canal was built, and a head of about 8 feet was created. On either end of that dam mills were built, and the owners leased the water power from the Government, and they have been extending these mills ever since and they now use about 12,000 second feet, and they have increased their head by dredging the river below, so they have a head of 12 or 13 feet, and develop about 12,000 horse power for use locally in the mills at Valleyfield. On the other side of the river the Government built a small power house at the mouth of the river à la Grasse to operate their locks and bridges.

Hon. Mr. MURPHY: That is on the Soulanges Section?

Mr. McLACHLAN: That is on the Soulanges Canal and on the Soulanges side of the river.

Hon. Mr. McMEANS: The depth of water in the Soulanges canal would not be of much use now.

Mr. McLACHLAN: It would not be of any use. If you wanted to make it 25 feet you would have to make a new canal.

Hon. Mr. BEAUBIEN: What is the new scheme of the Beauharnois power? On what side is it?

Mr. McLACHLAN: It swings around three miles south of Valleyfield and follows a route that we reported on in various ways. It follows through a low stretch of country. It is an overland canal entirely from lake to lake.

Right Hon. Mr. GRAHAM: Go on to Montreal.

Mr. McLACHLAN: Once you enter Lake St. Louis you have about 10 miles of deep, natural channel where nothing had to be done until you reach the foot of the lake opposite Valois Bay. From there to the head of the Lachine canal, about three miles, some dredging has been done in getting a 14-foot channel.

At the entrance of the Lachine canal the water surface is one foot below the level of the lake above. The Lachine canal leaves the river at Lachine and follows down the river for a mile or so, behind a dike; it then follows a natural valley in the country along the Canadian National Railway right down to Montreal Harbour. The fall is about 46 feet. It is overcome by five locks. In the river opposite there is a fall of about 32 feet between Lachine and Heron Island; then there is a few feet fall across Laprairie Basin, and then there is a 10-foot fall between Laprairie Basin and Montreal; most of this occurs just below Victoria bridge. About 24 feet of that 32 feet of fall is right in the Lachine rapids themselves, opposite Heron Island. There is a fall of about 9 feet in that stretch of river between Dorval Island and the head of the Lachine rapids. I might have explained that passenger boats drawing about $7\frac{1}{2}$ feet of water use the whole stretch of river from Prescott clear to Montreal without going through any locks or canals at all.

Right Hon. Mr. GRAHAM: The Canada Steamships.

Mr. McLACHLAN: The Canada Steamship passenger boats.

Hon. Mr. REID: Or the Richelieu and Ontario Navigation Company's.

Mr. McLACHLAN: The Richelieu and Ontario Navigation Company, as they were formerly. They draw about 7 feet 2 inches, I believe. They almost touch at a number of places. They almost touch in the Coteau rapids; they do touch sometimes in the Cedar rapids; they almost touch in the Split Rock rapids, and they almost touch at the head of Nun's Island, in Laprairie Basin.

There is a canal almost parallel with the Lachine canal, which is used by the city of Montreal for their water supply. It taps the river about three miles below Lachine, where the water is about five feet below the level of the water at Lachine, and they carry it through to the St. Pierre river, where they used to develop some power. Now they have their filtration works in that territory, and they waste back into the river what water they do not want. They have spent a lot of money on that project.

Hon. Mr. MURPHY: Mr. McLachlan, in the construction of that whole St. Lawrence canal system was there any power development, and, if so, was some of the power leased?

Mr. McLACHLAN: Oh, yes, a great deal. I will start at the upper end and come down, describing all these to you, if you wish.

Hon. Mr. MURPHY: I do not know whether the Committee would want it or not, but it is rather interesting.

Mr. McLACHLAN: That is very important.

Hon. Mr. MURPHY: It would be interesting to hear who controls this power.

Mr. McLACHLAN: Going back to the international section, there is a little power developed from the old canal at Cardinal. They have about eight feet head.

Hon. Mr. LYNCH-STANTON: Whose is that?

Mr. McLACHLAN: Canada Starch Works.

Hon. Mr. MURPHY: Is that leased?

Mr. McLACHLAN: That is leased.

Hon. Mr. MURPHY: Who leased it?

Mr. McLACHLAN: The Federal Government, Department of Railways and Canals. There is water power leased at Iroquois, at the foot of the Galop canal. The head is about fourteen feet. That was leased to the Beach estate. Then there is some water power leased at Morrisburg to the town for lighting and pumping. Some of this power, fortunately, is not used at all.

Hon. Mr. MURPHY: Are all these leased from the Dominion Government?

Mr. McLACHLAN: All leased by the Dominion Government; with injury in some cases to the use of the canals too.

Hon. Mr. REID: Those are questions before the Courts to-day.

Mr. McLACHLAN: Then off the Cornwall canal there are quite a number of power leases. The canal is tapped at the foot of Sheek Island by the St. Lawrence Power Company. The lease was given originally to M. P. Davis. It is now owned by the St. Lawrence Power Company, actually the Aluminum Company. They use about 1,000 second feet at a 28-foot head; and develop about 3,000 horse-power. Then the next lease down the river is at Lock 18, where the Howard Smith Paper Mills develop, I suppose, 1,000 horse-power. I could give you all those exactly, but I would have to look up my records. Then in Cornwall itself there are, I suppose, 3,000 or 4,000 horse-power leased to a number of organizations by the Federal Government. The cotton mills have the largest power house there. The town have a pumping station.

Right Hon. Mr. GRAHAM: The paper company use a lot.

Mr. McLACHLAN: And some other people use power there. Then when you come down to the Soulanges section you have, as I said, the old Valleyfield plant. Then you have the St. Timothee plant. Those are two Federal leases. Then there is M. P. Davis's plant, now called the plant of the Provincial Light, Heat and Power Company, which taps the Soulanges canal, using a head of about 50 feet. They develop about 15,000 horse-power at that plant.

Hon. Mr. REID: Between the two, or for each one?

Mr. McLACHLAN: No; the Provincial plant has about 15,000 horse-power, the St. Timothee 28,000 and Valleyfield about 11,000 horse-power.

Hon. Mr. MURPHY: All under lease from the Dominion Government?

Mr. McLACHLAN: All under lease from the Dominion Government. Then there is the Cedars plant, right out in the centre of the Cedar Rapids themselves, where about 200,000 horse-power is developed under lease from the Province of Quebec, not from the Federal Government at all.

Hon. Mr. MURPHY: That is not on the canal?

Mr. McLACHLAN: It is not on the canal.

Hon. Mr. BEAUBIEN: But they have a license from the Federal Government?

Mr. McLACHLAN: No. They submitted their plans to the Public Works Department and had them approved under *The Navigable Streams Protection Act*, and they also went before the International Commission. I do not know whether they got approval or not, but they went before the International Commission with their plans.

Then on the Lachine canal there are a lot of power leases. There are leases above lock No. 2 at St. Gabriel and at Cote St. Paul. These are Federal Government leases. Then in the Lachine Rapids themselves there is a Provincial

lease. That is the old Lachine Rapids Company, now owned by the Montreal Light, Heat and Power Company, who develop about 14,000 horse-power on a small head. That plant has been largely abandoned. It is not operated 90 per cent of the time, because of ice difficulties and things like that.

Hon. Mr. MURPHY: Are there leases along the Lachine too?

Mr. McLACHLAN: Yes, I mentioned that, Senator. There are at least three locks along the Lachine canal—at Cote St. Paul, at St. Gabriel lock, and just above Lock 2 at Montreal.

Hon. Mr. MURPHY: All from the Dominion Government?

Mr. McLACHLAN: All from the Dominion Government.

Hon. Mr. DANDURAND: How much of that power is leased to the Americans?

Mr. McLACHLAN: There is nothing leased to the Americans, but the Cedars Rapids plant supplies about 80,000 horse-power to the Americans.

Hon. Mr. DANDURAND: That is what I meant.

Right Hon. Mr. GRAHAM: That goes to Massena.

Mr. McLACHLAN: But the Federal Government have nothing to do with that. I suppose the Trade and Commerce Department have approved of the export of it.

Hon. Mr. REID: Mr. McLachlan, do you know whether the other power company, the one, I think, at Lachine, and another at Cedar Rapids, also applied to the International Joint Commission?

Mr. McLACHLAN: No. When this plant at Lachine was built there was no International Joint Commission on Waterways and they did not apply. The only one that ever went before the International Commission was the Cedar Rapids plant.

Hon. Mr. REID: That is the one leased to the Aluminum Company? At least, they get the power.

Mr. McLACHLAN: They buy the power.

Hon. Mr. REID: It is not in their name.

Mr. McLACHLAN: They went before the International Commission with their plans.

Hon. Mr. MURPHY: Are you aware, Mr. McLachlan, that the export of that power was once stopped by the company itself, and then was resumed?

Mr. McLACHLAN: No, I am not aware of that.

Hon. Mr. MURPHY: It is a fact, though.

Mr. McLACHLAN: It probably is. There is a plan which shows the territory from Montreal down to Quebec. Sea level is reached at Quebec. There is some work done below Quebec, but we did not bother showing a plan of it. The red areas on the plan show where excavation is done in the river. The slope varies from about 18 feet to say 28 feet between Montreal and the sea, depending on the flow of the river. There are about 65 miles of improvement channel in the river between Montreal and the sea. This length of dredged channel is about the same as the total in the St. Mary's, St. Clair and Detroit rivers except there are no two-way channels in the St. Lawrence.

Hon. Mr. L'Esperance:

Q. Between Montreal and Quebec is what depth?—A. The channel is 450 feet and 30 feet deep.

Q. It is a deep-sea channel?—A. Yes, they have a 35-foot project about 60 per cent done; that is under the Marine Department.

Hon. Mr. McDougald: You were asked about the leases for the development of power; did you refer to the International Waterways Board? Did they make a decision on that?

Mr. McLACHLAN: I do not know of any decision ever being rendered in connection with the matter.

Hon. Mr. McDougald:

Q. Could they make a decision without referring to the Department of Public Works?—A. I don't know anything about what they could do. I know they went to the International Commission and explained their plans. I do not know what the Commission did. I do not think there is any document that shows what the Commission did.

Hon. Mr. Murphy:

Q. That is the Commission that existed before the International Joint Commission?—A. Yes, that is right.

Hon. Mr. McDUGALD: It was not the International Waterways Board?

Mr. McLACHLAN: I am a little bit hazy on that. It must have been about 1910 they appeared before the Commission and the Treaty was made in 1909. I would have to look that up to see which Board it was; I am not sure which. I do not believe there is any public record of an order or anything like that. I think they just listened to what they had to say, and being satisfied that the boats drawing seven feet of water were well able to continue using the river they saw no reason for objection, and made none. I think that is what happened.

Hon. Mr. MURPHY: You had better verify that and let the Committee have it later.

Mr. McLACHLAN: All right.

Hon. Mr. REID: Is it Mr. Skelton that would know about that, or could we get the secretary of the International Joint Waterways Commission, who have all those records, to produce the records?

Mr. McLACHLAN: I think you had better go to him.

Hon. Mr. MURPHY: That is right. It is Mr. Burpee.

The Committee then adjourned at 1 p.m. until to-morrow at 11 a.m.

MINUTES OF EVIDENCE

THURSDAY, 3rd May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River resumed this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

The CHAIRMAN: Mr. Starr, of Toronto, is present and wishes to say a few words to the Committee in reference to some witnesses he understands would like to appear before the Committee. Mr. Starr.

Mr. J. R. L. STARR: Mr. Chairman, I have been asked to attend here by the Dominion Securities Corporation, of Toronto, to assist the Committee in getting the fullest possible information on this whole question, and with that object in view I am submitting to you a list of witnesses, whom you will all recognize as very prominent engineers and prominent men, and whom I would like called, to be heard here. Later on, to save time, if you think that advisable, I would take the witnesses over the proposition; but that is in your hands.

Hon. Mr. MURPHY: Before we get into that, Mr. Chairman—how and why are the Dominion Securities Corporation interested in this matter? What is their interest in it?

The CHAIRMAN: I do not know. Perhaps Mr. Starr would read the names of the persons.

Hon. Mr. MURPHY: That would hardly give us the information for which I have asked.

Hon. Mr. DANDURAND: Yes, I am surprised at the Dominion Securities Corporation. All the trust companies in Canada might rise up and bring us a list of witnesses and we would be here until doomsday.

Hon. Mr. MURPHY: Certainly we would. What is their interest in that?

Hon. Mr. LYNCH-STAUNTON: Why should they not tell us, anyway, no matter what their interest is?

Hon. Mr. MURPHY: I do not know why they should not, but I would like to know, that is all; because, as Senator Dandurand remarked, if all the companies that may have some interest in this come here and present a list of witnesses for us to listen to, we shall be here until doomsday without a doubt.

The CHAIRMAN: Of course we shall be limited a little by time anyway. Mr. Starr asked leave to make this statement, and of course we can decide afterwards.

Hon. Mr. MURPHY: I do not object to Mr. Starr making the statement. I merely want to know what is the status of the people whom Mr. Starr represents before this Committee, that is all. I do not object to his making a statement. Surely we are entitled to that information. If an engineer comes here we shall know he comes here to give us engineering technical advice.

Hon. Mr. DANDURAND: But we do not intend to go into technical matters.

Hon. Mr. MURPHY: But we have got it from Mr. McLachlan.

Hon. Mr. DANDURAND: We here are in a primary school.

The CHAIRMAN: Who are the persons?

Mr. STARR: The list is as follows:

Dr. Thomas Hogg, Hydro Electric Engineer, Ontario Hydro Electric Commission,

Fred Brown, Hydro Electric Engineer, Montreal,

Mr. Grant, Government Engineer on the Welland Canal,

Professor Goforth, of McGill University, re Economics,

General Tremblay, of Quebec Harbour Commission,

Loring Christie, Legal Adviser of the Ontario Hydro Electric Commission,

Thomas Harling, Shipping Agent, Montreal,

J. T. Johnson, Head of Dominion Water Power Branch, Department of the Interior,

R. A. C. Henry, of C.N.R., Economist and member of Joint Committee on St. Lawrence Terminal.

The CHAIRMAN: Mr. Starr will hand the list in.

Hon. Mr. MURPHY: Mr. Chairman, I want it understood that I am going to press for this information.

The CHAIRMAN: That is all right.

Hon. Mr. LYNCH-STAUNTON: Why cannot Mr. Starr tell us?

Hon. Mr. MURPHY: Why can't he?

Hon. Mr. LYNCH-STAUNTON: Tell us now, sir.

Mr. STARR: I could not, because I never asked them what their interest was. They simply asked me to arrange for the calling of these witnesses. I had not the curiosity that the honourable senator here has, to ask them why; but I have no doubt I can procure that information for you.

Hon. Mr. DANDURAND: The names are of interest to us.

Hon. Mr. MURPHY: That should have been done by letter.

The CHAIRMAN: Mr. McLachlan gave us a very interesting description yesterday. I think he is prepared to go on with further matter of interest to the Committee.

Mr. D. W. McLACHLAN recalled.

Mr. McLACHLAN: Mr. Chairman, I described yesterday the physical conditions from the head of the Lakes to Montreal as well as I could, and at that point, I think, you agreed that it would be better to stop, and to-day start with the description of what our report proposes to do with the river—what changes or improvements are proposed in each of the several sections, starting from the head of the Lakes and going down to Montreal.

You will recall that I said yesterday that there was a 20-foot drop between Lake Superior and Lake Huron and that there is a lock and a control dam in that river. There are three locks on the American side, one on the Canadian.

Hon. Mr. DANDURAND: Who built that dam?

Mr. McLACHLAN: The power companies built that dam. The power companies on the American side built one-half the dam, out to the boundary, and

the power companies on the Canadian side built it out to the boundary on the other side, under a permit or an order from the International Joint Commission. Does that answer the question?

Hon. Mr. DANDURAND: Yes. Did they build it by joint understanding?

Mr. McLACHLAN: A joint understanding.

Hon. Mr. DANDURAND: Under a single contract?

Mr. McLACHLAN: The two companies came to the International Joint Commission separately and there were two orders issued, one order covering the work to be done on the American side, the other order covering the work to be done on the Canadian side; but the understanding was that it was the one problem. If there had not been two countries concerned there would have been just the one order, but as there were two countries, there was an order for the work on the one side and another order for the work on the other.

Hon. Mr. LYNCH-STAUNTON: It was like the building of an international bridge?

Mr. McLACHLAN: Yes, like an international bridge.

Hon. Mr. COPP: If I remember correctly, it was in order to maintain the level.

Mr. McLACHLAN: Yes, to maintain the level, because there were power diversions on either side and they were lowering the level, and they put this in to hold up the lake and enable them to control it. It is not in the interest of navigation or power or anything else to allow water to flow as it does in nature. It was built to control and hold back the flow at certain periods and let it go at others.

Hon. Mr. WILLOUGHBY: How was it paid for? Fifty-fifty?

Mr. McLACHLAN: I do not know that anybody knows just how the cost was divided between the power companies, but I suppose they paid fifty-fifty.

Hon. Mr. WILLOUGHBY: Did our Government pay anything?

Mr. McLACHLAN: Our Government paid nothing; neither did the American Government.

Hon. Mr. WILLOUGHBY: That is what I wanted to know.

Hon. Mr. DANDURAND: In what year was that started?

Mr. McLACHLAN: It was started about 1914 and it was finished, I suppose, about 1917, I would say—or perhaps 1916. I could look it up. Some works were also built in earlier years on the United States side. These had no Canadian approval. Now, as you know, the two new American locks at the Sault have 24½ feet on the sill. What we recommend is that the channels below that lock be deepened to 25 feet and the channels above be deepened to 25 feet, giving a depth six inches more than on the sills of the locks. That would enable a boat with 23½ feet draft to go freely through those locks and channels.

Hon. Mr. MURPHY: Pardon me, Mr. McLachlan. You are now referring to the contents of the report of the Joint Board of Engineers?

Mr. McLACHLAN: Yes, absolutely. There were no compensating works or for changing of levels above the locks.

Hon. Mr. BEIQUE: You will tell us when there is a difference of opinion between the two sections?

Mr. McLACHLAN: Yes, we will give you that when we come to it.

Hon. Mr. LYNCH-STAUNTON: Mr. McLachlan, you remember telling us yesterday of the dangers of the channel between Kingston and Prescott by reason of the depth and in connection with the floor of the river, and width. How about those dangers in the St. Mary's river?

Mr. McLACHLAN: Well, they are not nearly so great, for this reason. They have two separate channels. I mean, they have a 600-foot channel, where the boats use one channel both ways and they have a 300-foot channel where they are separated one up and one down. There is no very deep water. Where the currents are swift the water is not deep. So the boat has a chance to drop anchor and stop in case of danger. But that is a very real danger up there—even at that. The American Government just a few days ago, as you know, adopted a project to widen one of the channels to 600 feet. You noticed, I think, that they have authorized a further expenditure of \$24,000,000 in the inter-lake channels, and when that much is expended they will have one channel 600 feet and another channel 300 feet. So the 600-foot channel will be wide enough for a two-way channel. They will all be shallow; that is, relatively shallow.

Hon. Mr. LYNCH-STAUTON: They will be able to get an anchoring?

Mr. McLACHLAN: They can get a hold on the bottom.

Hon. Mr. REID: When those locks were originally built they would take a vessel deeper than, say, 18 feet?

Mr. McLACHLAN: Oh, yes; they were supposed originally to be built for twenty feet.

Hon. Mr. REID: That is, on our side?

Mr. McLACHLAN: On our side. Our lock was supposed to be built for 20 feet, but in recent years the lowering of Lake Huron, from the causes that I gave you yesterday—the Chicago diversion, dredging of gravel, and some enlargements for navigation—has meant that the level of lake Huron has run down about a foot and a half.

Hon. Mr. REID: Another question, Mr. McLachlan. Did the putting in of the two power plants at Sault Ste. Marie have any effect in lowering Lake Superior?

Mr. McLACHLAN: Well, as I said, it was to correct that effect that the compensating works were built. It was having that effect.

Hon. Mr. REID: That is why the dam was put in?

Mr. McLACHLAN: That is why the dam was put in.

Hon. Mr. REID: Then if you deepen the water above Lake Superior that will take more water, will it not?

Mr. McLACHLAN: No.

Hon. Mr. REID: Or will the power companies be able to take it?

Mr. McLACHLAN: It will not make any difference. I might say here that the length of channel that will be improved, or the length of dredging in the one way channel will be about 22 miles between Lake Superior and Lake Huron. Part of the channel is in rock and part in earth. We do not need to deepen the channels in Hay lake or Mud lake; they are deep enough already.

Hon. Mr. REID: How many feet have you to go down underneath the present channels?

Mr. McLACHLAN: About five feet.

Hon. Mr. REID: And a foot and a half of that is caused by the power company?

Mr. McLACHLAN: No; anything that is caused by the power company has been compensated for by the control.

Hon. Mr. DANDURAND: And the dredging will be all on the American side?

Mr. McLACHLAN: Yes. Now we will consider the stretch of rivers between lake Huron to lake Erie.

Hon. Mr. MURPHY: What is the name of the river?

Mr. McLACHLAN: River St. Clair, lake St. Clair, and the Detroit river. There is a five foot fall between lake Huron and lake St. Clair. River St. Clair is generally deep enough for 25 foot depth from lake Huron to lake St. Clair.

Hon. Mr. MURPHY: How many miles?

Mr. McLACHLAN: Forty miles. Just at the outlet of lake Huron we run into three or four miles of dredging. The level of the water at the foot of lake Huron is the same as the level of the water in the lower St. Mary's river on the other side of the lake. To get the 25 foot channels we purpose to steepen up the slope of the St. Clair river to a certain extent, and reduce dredging to a certain extent by this means; we propose to raise the level of lake Huron a foot by compensating works. Those compensating works are shown in elevation by the red lines on the profile. If you can imagine the water flowing down the river you will see transverse barriers made out of broken stone weirs will retard the flow and will steepen up the slope of the river and compensate for the losses of level by gravel dredging, navigation dredging, and loss of level through those various causes, and save us considerable dredging at the foot of the St. Mary's river and at the outlet of lake Huron, as well as in all harbours on that level. The improvement proposed from lake Huron down to lake Erie is to be secured largely by dredging. The length of channel to be improved in the St. Clair river is 10 miles; in lake St. Clair, 15 miles; and in the Detroit river 16.25, mostly in the Livingstone channel territory, above and below it.

Hon. Mr. MURPHY: Is that an existing improvement, or proposed?

Mr. McLACHLAN: That is the proposed improvement. Now, at the outlet of lake Erie we propose compensating works also. These will raise the lake about $\frac{7}{10}$ of a foot. The works are shown at the front of our report before the reading matter.

Hon. Mr. LYNCH-STAUTON: That is at Port Colborne?

Mr. McLACHLAN: That is in that Niagara river—at the outlet of lake Erie. I will show it to you on a chart.

Hon. Mr. BEIQUE: You might say what is the cost approximately, and the extent?

Mr. McLACHLAN: I will try to do that. We propose to spend \$21,000,000 in St. Mary's river. We propose to spend in dredging the river St. Clair, lake St. Clair and Detroit river another \$20,000,000. We propose to spend on compensating works in the St. Clair river \$2,700,000.

Hon. Mr. LYNCH-STAUTON: Additional?

Mr. McLACHLAN: Additional. We propose to spend at the outlet of lake Erie about \$700,000.

Hon. Mr. REID: What is the depth of water across lake Erie now?

Mr. McLACHLAN: Lake Erie is only a shallow lake, about 50 feet deep. It is shown in the elevation on a diagram.

Hon. Mr. MURPHY: That is the maximum depth, is it?

Mr. McLACHLAN: If you will look at this profile on the wall you will see that lake Superior is very deep; lake Huron is not so deep; lake Erie is shallow and lake Ontario is deep again.

Hon. Mr. REID: As far as navigation is concerned, what is the draught across lake Erie?

Mr. McLACHLAN: You can get 30 feet throughout easily. At the upper end of lake Erie there is a stretch that is not much more than 30 feet from Point Pelee into the mouth of the Detroit river.

By Hon. Mr. Reid:

Q. What I meant was, by the compensating work at Niagara there would be a safe 25-foot navigation across lake Erie?—A. Yes, we raise the lake by taking advantage of a deep part of the river just above the new bridge. That is, we obstruct the flow by transverse weirs, and yet we do not carry the tops of those weirs high enough to reduce the natural depth of navigation down the open river from lake Erie to the Tonawanda. As you know, boats drawing 13 feet of water, frequently use the river down to Tonawanda. We tried to find a way of deepening lake Erie without interfering with useful navigation elsewhere. We found we could do this by putting transverse weirs in the stretch of river above where the new bridge is built. They are shown in profile on the diagram. Those little obstructions that you see sticking up from the bed of the river are weirs made out of broken stone, 50 feet wide on top and slopes 4 to 1 upstream and down. They are placed transversely in the deep part of the river. They are intended to steepen the slope and give six inches more depth in all the channels in lake Erie and reflects back a little into lake Huron also. I may say here we were asked as a Board to consider the possibility of regulating all the lakes so as to increase navigation depths so as to compensate for the Chicago diversion, also so as to improve the outflow of the rivers for power and all those things. As you know, if you have followed the various controversies that have grown up around the lakes, Chicago, for instance, has advanced the idea that regulation of all the lakes would cure all the evils that they have brought about, that has been brought about by deficient rainfall and everything of that nature. We as a board went into that thing very carefully, and when we were through we found that we could not regulate those lakes and raise them all up an average of a foot in the low water periods at the end of each summer at any reasonable cost. We found we could secure all benefits by dredging and by compensating works, for half the money that regulating works would cost. As a consequence we condemned the idea of regulation of all lakes advanced by a great many people. As you know, the city of Chicago, employed a very large number of engineers and they reported very favourably on that kind of scheme. I think it is a very good thing that we have cleared up that situation, because it has disposed of a heresy; and further it has more or less removed something in the way of a menace to Canada. The benefits that would come from raising the lake levels would fall mostly on the United States ports and United States shipping; with such a thing done there would be losses also and these would fall on shipping along the canals and from Montreal to the sea which is largely Canadian. I think it is a good thing internationally that that heresy is disposed of. By those compensating works at the foot of lake Erie and lake Huron, we get everything that is to be gotten by using the storage of the lakes. That is, if you look into the action of compensating works you find they raise the high water level just as much as they raise the low water level, and they raise the mean level as much as they do the two extremes; so we get the natural benefit of the fluctuation of the lakes, and do not involve ourselves in any of the responsibilities that would arise from the structure that you would have to open and close according to some rule that we would agree on internationally. That is, we saved ourselves a lot of trouble by avoiding that business.

Hon. Mr. LYNCH-STAUNTON: I thought you said a moment ago that when you disposed of that heresy you put compensating works in for the purpose of raising the water?

Mr. McLACHLAN: No, I meant regulating works; the difference between compensating works and regulating works is this; regulating works would be something like they have it the Sault—a dam right across the river in which there would be gates that you would open and close and where the outlets of the

lake are very much enlarged beyond what they were in nature. You would no doubt lay down rules as to conditions under which you would open and close. We call that a regulating work. That is, we would have almost complete control of the flow.

Hon. Mr. LYNCH-STAUTON: What you call the heresy is the compensating works?

Mr. McLACHLIN: Compensating work is simply an obstruction placed in the bottom of a channel that deepens its slope.

Hon. Mr. L'ESPERANCE: It works naturally.

Mr. McLACHLIN: It works naturally. Having been put there you would never touch it afterwards. That is a ticklish thing to explain, and I don't know whether I have covered it so as to make it clear.

Hon. Mr. L'ESPERANCE: We understand it perfectly.

Hon. Mr. LYNCH-STAUTON: Yes, it is clear now.

Mr. McLACHLIN: In our report we were asked how much it would cost to compensate for the loss of level due to the Chicago diversion. Well, we figured it out as a part of what is proposed in the several cases and we gathered the figures, but that is not anything that we recommend; that was just for your information—the answer that was given to those specific questions in regard to the Chicago Diversion. The compensating works that we recommend are something that are required, at least we recommend them for getting the channel depth desired, which is 25 feet.

Hon. Mr. LYNCH-STAUTON: Have you come to the conclusion that those remedial works that you are putting in the channels are going to counteract the evil that arises from the Chicago diversion?

Mr. McLACHLIN: Just in regard to those things that it deals with. The works that we propose in the St. Clair river will more than compensate for the loss in level in that lake, due to the Chicago diversion.

Hon. Mr. LYNCH-STAUTON: Then we will have no complaint about the Chicago after that.

Mr. McLACHLIN: Not in regard to that lake; not in regard to that place.

Hon. Mr. LYNCH-STAUTON: In regard to anything? So far as you have considered it I mean; so far as engineers have considered it, will we have any complaint against Chicago once those works are done?

Mr. McLACHLIN: There will be lots of complaints elsewhere I guess. You will have lots of complaints below Montreal. We can only compensate at certain places; at least we only try compensating at certain places. If it were possible we might compensate at all kinds of places but it would be absurd to do so on account of the cost, before all the rivers below are held up by dams.

Hon. Mr. SPENCE: I am not a member of the Committee, but do I understand those compensating works at the foot of lake Erie would raise the level of the harbours of lake Huron and Georgian Bay?

Mr. McLACHLIN: It would raise the water in the harbours about a foot.

The CHAIRMAN: I might explain that any member of the Senate, though not on the Committee, is privileged to ask a question.

Mr. McLACHLIN: The Welland ship canal, is about 80 per cent completed. I think I described it yesterday—27 miles long; has 8 locks; overcomes a lift of 326 feet; is 27 feet deep in rock, and 25 feet in earth, generally.

Hon. Mr. REID: If all the works are carried out that you have described this morning, a vessel loaded at Port Arthur drawing 25 feet, could safely navigate to Kingston?

Mr. McLACHLIN: The works I described this morning would only enable a boat of about 23½ feet draught to go from Port Arthur to Kingston. In our

report we give the cost of making it 27 feet, which would enable a 25 foot boat to go between those places. We also give the cost of making the channel 30 feet deep, which would enable a boat of 28 feet to go through. I might explain that the United States Government engineers are averse to making a channel between lake Superior and lake Erie deeper than 25 feet at present, because they think they would have to turn around and deepen all their harbours and they are inclined to the view that the best thing to do is not to go more than that depth until it proves a success and the navigation interests make further demands.

Hon. Mr. REID: Therefore we would take it for granted that the intention of the Commission was that when this work is completed down as far as Kingston it was intended for vessels laden to 20 feet depths?

Mr. McLACHLAN: That is not right. 23 feet.

Hon. Mr. COPP: With the proposal and the Welland Canal they would complete that?

Mr. McLACHLAN: Yes.

Hon. Mr. COPP: You would not have to do anything extra to the Welland Canal?

Mr. McLACHLAN: I noticed the other day in the papers that the United States have a project for deepening all those channels I have described to 23 feet in soft bottom and 24 feet in hard bottom. I believe \$24,000,000 was the amount they gave in Congress; so you might assume that all those channels had been deepened to 24 feet now, no matter whether the Deep Waterway Scheme goes through or not. They had a long debate whether it would be 23 feet, 24 or 25 feet.

Hon. Mr. MURPHY: To which channels will that apply?

Mr. McLACHLAN: To all the channels between lake Superior and lake Erie I believe.

Hon. Mr. MURPHY: Irrespective of this waterway?

Mr. McLACHLAN: Irrespective of this thing.

Hon. Mr. WILLOUGHBY: And at their expense.

Mr. McLACHLAN: At their expense.

Hon. Mr. REID: What are the vessels? Twenty-one foot draught?

Mr. McLACHLAN: Two feet less than the depth if channels in hard bottom.

Hon. Mr. REID: What is the draught now at which vessel can come safely from Port Arthur?

Mr. McLACHLAN: It varies with the seasons of the year. There is an order issued from month to month.

Hon. Mr. REID: What is the minimum?

Mr. McLACHLAN: It has gone down to eighteen feet in November of some years.

Hon. Mr. LYNCH-STAUNTON: Across lake Erie?

Mr. McLACHLAN: Through the channel in the St. Mary's and Detroit rivers.

Hon. Mr. REID: The minimum from Port Arthur to Kingston to-day is 18 feet.

Hon. Mr. BEIQUE: And that is to be raised to 21 feet?

Mr. McLACHLAN: Twenty-two feet sure and very probably 23 feet.

Hon. Mr. DANDURAND: The American government has voted the money for that?

Mr. McLACHLAN: Yes, I noticed that in the papers a week ago.

Hon. Mr. DANDURAND: And that covers Canadian water as well?

Mr. McLACHLAN: It will, yes.

Hon. Mr. LYNCH-STAUTON: Does that mean that they will put in compensating works?

Mr. McLACHLAN: I guess so. I cannot discuss this matter.

Hon. Mr. LYNCH-STAUTON: Are compensating works contemplated in the scheme they have announced?

Mr. McLACHLAN: I don't know. There is a feeling in the United States that they would like to go ahead with the compensating works irrespective of what else is done.

Hon. Mr. LYNCH-STAUTON: It strikes me that if you lower the channel you are going to lower the water in their harbours above.

Mr. McLACHLAN: If you make any greater depth?

Hon. Mr. LYNCH-STAUTON: Yes.

Mr. McLACHLAN: That is not necessary, because they can easily deposit the spoil in the river in such a way that it will not lower the lake.

Hon. Mr. LYNCH-STAUTON: They leave it there, and it makes no difference in the channel?

Mr. McLACHLAN: I should imagine the United States Government would want to put in the compensating works in the outlet of lake Erie and the outlet of lake Huron along with their deepening project.

Hon. Mr. REID: I asked you about a vessel leaving Port Arthur and coming to Kingston, and you spoke of 18 feet. Is 18 feet the maximum?

Mr. McLACHLAN: Oh, yes. 18 feet is the minimum. In the spring of the year, or in July and August they can carry probably 2 feet more than that.

Hon. Mr. LYNCH-STAUTON: If these things are facts, we need not concern ourselves with anything above Detroit.

Mr. McLACHLAN: You need not concern yourself with anything above lake Erie.

Hon. Mr. GILLIS: How much of that work would be in Canadian territory?

Hon. Mr. DANDURAND: From lake Superior to lake Erie?

Mr. McLACHLAN: I would not think more than 10 per cent, and that part would be confined to the Amherstburg channel and part of the Livingstone channel. There is a part in the Detroit river where both channels are in Canadian territory.

Now, if I have covered that part to lake Ontario to your satisfaction, I would like to go on.

Hon. Mr. BEIQUE: Are we to understand that the ports of the United States below Chicago have a common interest with us against the diversion at Chicago?

Mr. McLACHLAN: Oh, absolutely. They have a common interest against the diversion at Chicago; but if we compensate for the level of the lakes on which they are, that interest might vanish.

Now, between lake Ontario and Prescott we have a fall of about a foot. I discussed that yesterday. We propose to spend a little over a million dollars in improving it. The channel is partly in Canadian territory and partly in United States territory.

Hon. Mr. REID: Is it intended that the largest vessel that comes down to Port Colborne or Buffalo now should be able to come on through as far as Prescott?

Mr. McLACHLAN: That is what ought to be done.

Hon. Mr. LYNCH-STAUTON: If your scheme is carried out that will occur.

Mr. McLACHLAN: That ought to be done.

Hon. Mr. REID: If a 500,000 bushel vessel now runs to Port Colborne, could a 200,000 bushel vessel come down through there now before those works are completed?

Mr. McLACHLAN: This is a matter of opinion among engineers. It is a generally accepted principle in dealing with navigation improvements—open water improvements—that the channel should be as wide as the boat is long, if there is much current. In several parts of the river below Alexandria Bay on the American side, and in the Brockville narrows there is only a natural width of about 360 feet, and I would think that would be about the maximum length of boats that could go down safely.

Hon. Mr. REID: I think the maximum now is 250 feet, so there is an increase. It is about half as long again as the present vessel.

Mr. McLACHLAN: Does the Committee want to see a plan of where that channel between lake Ontario and Prescott is on the Canadian side and where it is on the American side?

Hon. Mr. REID: Yes.

Mr. McLACHLAN: I could not bring along a chart specially prepared for this purpose, but I have a tracing that shows it. As you see, there is lots of depth and width down as far as Clayton on the American side, and the foot of Howe island on the Canadian side. This chart starts from Clayton. The international Boundary is south of Howe island and swings north of Grindstone island and Wells island and follows close to the Canadian shore and continues that way to Crossover Light, then it is on the American side of the channel. The Canadian channel is very restricted through Fiddler's Elbow and so very crooked, it would cost about \$12,000,000 to get a practicable channel from the foot of Howe island down to Prescott on the Canadian side, whereas a channel just as good can be gotten on the American side for about \$700,000.

Hon. Mr. REID: That is the one that is used now?

Mr. McLACHLAN: The one that is used is on the American side.

Hon. Mr. REID: Partly in Canada.

Mr. McLACHLAN: It is wholly in the United States, and wholly in the river. Now, when you come to Brockville narrows the channel is on the north side of the boundary close to the Canadian shore and there is no practical channel on the American side. It would cost \$5,000,000 to get a channel on the American side while we could get it on our side for \$500,000. We think the estimates I have given are pretty skimpy for caring for a 600 foot boat, and later investigation by another Board of which I was a member forced us to increase these estimates to about \$2,000,000 in this territory. That would make absolute and first-class provision which would enable 600 foot boats to use the channels, and I think we will have to spend it before we are through.

Hon. Mr. DANDURAND: \$2,000,000 on the American side and \$2,000,000 on the Canadian side?

Mr. McLACHLAN: Yes. In the Thousand Islands section the American Department of Commerce put out the buoys on their side, and our Department of Marine and Fisheries put them out on our side.

Hon. Mr. HUGHES: What is the mileage?

Mr. McLACHLAN: About 40 miles on the American side and 20 miles on the Canadian side.

Hon. Mr. BEIQUE: Did the Advisory Commission consider the change of the boundary?

Mr. McLACHLAN: We never considered a change of the boundary in that territory. It is only below.

Hon. Mr. LYNCH-STAUNTON: There is no necessity of changing the boundary except where you come into the State or the Province. In the river there is no necessity.

Mr. McLACHLAN: Not that we ever considered.

Now we come to the International Rapids Section. There is a fall of about 91 feet from Prescott to Cornwall. As you know, as a Board of Engineers we do not turn in a unanimous recommendation as to what should be done in this section, and I would like to reserve the right, if I may, to cut out from your written record some things I may say which I would not want to appear in a printed document. If you do not accord me a privilege of that kind I will have to be pretty careful about what I say.

Hon. Mr. LYNCH-STAUNTON: Cut it down if you like.

Hon. Mr. WILLOUGHBY: Could you not get the authority of the Chairman?

Hon. Mr. REID: When you are revising it, cut out what you want.

Mr. McLACHLAN: I would like to have that privilege.

Right Hon. Mr. GRAHAM: I think it would be wise for some person to ask the newspapers to cut it out too, or else something may get into them to cause a misunderstanding between the two countries. I would be guarded in what I said if I were you, Mac.

Mr. McLACHLAN: There is only the one record being made, is there not?

The CHAIRMAN: I intended that this manuscript should be submitted to you for revision. Before any printing is done it will go through your hands.

Mr. McLACHLAN: That will be fine.

We could not agree on a recommendation to be made to the two countries; we were forced to disagree; the whole matter of the International Section will no doubt come up for further consideration, and some day some body of engineers must agree.

Hon. Mr. COPP: Between what two points is the International Section?

Mr. McLACHLAN: The International Section--

Hon. Mr. MURPHY: The International Rapids Section.

Mr. McLACHLAN: Thank you. The International Rapids Section runs between Johnstown and the head of Lake St. Francis, which is below Cornwall. On the International Rapids Section we have a series of canals on the Canadian side. These pass various swift parts of the river all the way down. Messrs. Wooten and Bowden who were a body of engineers who preceded us—made a specific recommendation as to how that river was to be improved. This plan shows what they recommended to be done between Chimney point and Cornwall.

Hon. Mr. REID: Was that report of theirs made with a view to the development of the full power at the Long Sault?

Mr. McLACHLAN: I will explain that. Mr. Bowden was Chief Engineer of the Department of Railways and Canals, and Col. Wooten was a United States army officer. They met and considered this problem many times.

Hon. Mr. MURPHY: You might explain what Board they belonged to or constituted.

Hon. Mr. DANDUARD: And how they come together.

Mr. McLACHLAN: That is quite a long story. I thought Dr. Skelton was going to file a statement that would be complete in regard to that.

The St. Lawrence waterways project was referred to the International Joint Commission and two engineers were appointed to assist them, one by each Government. These engineers were instructed to prepare a plan and submit it to the International Joint Commission. The International Joint Commission were instructed to consider the matter—not only the report of this

pair of engineers, but any plans anyone might prepare and submit—which they did. Then after the International Joint Commission reported, the Canadian Government, as you know, appointed a National Advisory Committee, and the United States appointed an Advisory Committee. Each government appointed a Board of Engineers. These two bodies of engineers were instructed to get together and review this whole matter, including the improvement of the upper lakes, compensation for diversions, and many other things.

Hon. Mr. MURPHY: My question was as to how Wooten and Bowden came to be appointed. They were appointed by the International Joint Commission?

Mr. McLACHLAN: No. They were appointed by the Government.

Hon. Mr. MURPHY: You should have said that they were appointed after the questions were referred to the International Joint Commission in January, 1920.

Mr. McLACHLAN: Quite right.

Hon. Mr. MURPHY: Instead of that each Government designated these two engineers to co-operate and advise the International Joint Commission.

Mr. McLACHLAN: You are quite right.

Right Hon. Mr. GRAHAM: One little point you left out, showing why you went to work. This International Joint Commission, after receiving the report of Col. Wooten and Mr. Bowden, made a recommendation in a paragraph near the end of their report advising that before anything was done an enlarged Joint Engineering Board should be appointed to further investigate the matter, and this Joint Engineering Board is the result of that recommendation.

Mr. McLACHLAN: I might point out that in the report of the Department of Railways and Canals for the year ending March 31st, 1924, pages 8, 9, 10 and 11, there is a fairly full description of what has happened in regard to the appointment of these several Boards. And then in our own report, pages 2, 3 and 4, there is a summary stating the questions that we were asked, and how we came to be appointed. There is some repetition between the two documents, but they together will give you a fair statement of what has happened.

Right Hon. Mr. GRAHAM: Your duties are all laid out?

Mr. McLACHLAN: They are all laid out. We are asked specific questions. Now, if I might deal with this International rapids section. Messrs. Wooten and Bowden recommended what they called a single stage plan of improvement, but with a control dam near the upper end of the section, where there would be a head of about 8 feet in summer and just about a foot in winter. As a scheme it was very like the second diagram from the top of the sheet on the wall. It had a control dam with about an 8-foot head near the top of the section and a head of 74 feet at the lower end of the section.

Hon. Mr. LYNCH-STAUNTON: I do not understand that yet.

Mr. McLACHLAN: Will you ask me a question, or shall I try to repeat?

Hon. Mr. LYNCH-STAUNTON: I would like you to explain it a little more clearly. I cannot ask you a question; I do not understand it.

Mr. McLACHLAN: Well, I will show you on the plan. They proposed to build a dam at Ogden Island.

Right Hon. Mr. GRAHAM: Ogden Island is at Morrisburg, is it not?

Mr. McLACHLAN: Yes. They proposed to put a dam at Ogden Island, just above Morrisburg, where there was to be a head of about 8 feet in summer and one foot in winter. They proposed to do a lot of excavating in the river from the head of Galops Island down to that point, a length of 15 miles. That excavation was supposed to be sufficient to almost bring down the level of

the lake to that of the dam. But the excavation was not enough to form an ice cover in that stretch of river. The river would still run open in winter, and that would make a lot of frazil, it would fill up the upper end of this lower section in winter, destroying seven feet of head every winter. In the Long Sault rapids they proposed a dam at the head of Long Sault Island, then a dam from Long Sault Island to Barnhart Island, then they have proposed a power house at the foot of Barnhart Island, and an embankment from there to Sheek Island. From Sheek Island the banks continued to Farran's Point.

Hon. Mr. LYNCH-STAUNTON: Continued what?

Mr. McLACHLAN: Continued along the top of hardpan ridges—

Hon. Mr. LYNCH-STAUNTON: What continued?

Mr. McLACHLAN: The banks continued along the top of ridges until they struck the high land downstream from Farran's Point. Now, when we came to investigate the matter still further, violent exception was taken to the loss of power proposed. This destroying of seven or eight feet of head perpetually in this stretch of river was considered to have great economic importance, we, figuring it out on the basis of coal values and we had to admit its recovery would justify the expenditure of \$50,000,000 or something like that. So we were faced with the necessity of trying to work out a scheme that would develop more power for posterity, even though it is quite costly now.

Well, working along those lines, the first thing that we developed was a scheme along much the same lines, but with the lower level higher and the loss in head at the upper dam less.

Hon. Mr. LYNCH-STAUNTON: The level at Ogden Island?

Mr. McLACHLAN: The level in the second reach higher, and a control dam with a lower head. With that scheme we moved the control dam upstream—we were forced to adjust ourselves to the fact that at certain places we could build dams and at certain places we could not—we moved the dam according to our scheme up to the head of the rapids at Galops Island. We started that dam across the artificial channel passing through Galops Island, then we carried that dam through a lock which was proposed at Lotus Island and on to the American shore. These dams are shown in the heavy lines in the diagram. I will not speak of head yet. Then we proposed to excavate all those areas shown in red to a depth of about 27 feet, and that enlargement of channel enabled us to raise the level from Morrisburg down to the dam at the Long Sault seven feet above what was proposed by Messrs. Wooten and Bowden that meant that there was a loss of head up at this control dam here, in summer, of about $3\frac{1}{2}$ feet, and it would gradually drop down to perhaps six inches in winter. That is shown in the red work on the plans. The hatched red work is excavation. That scheme necessitated a considerable length of embankment, because the water from Chrysler's Island down to the head of Barnhart Island was held higher than the level of the main road along the shore, and higher than the level of the country in some spots. The embankments proposed were to start below Weaver's Point and run continuously all along the river to the power house at the foot of Barnhart Island and then run up the other side half the length of Barnhart Island, and then along the other side of the river also, as far west as Weaver's Point again.

Hon. Mr. LYNCH-STAUNTON: All this will drown out our canals entirely?

Mr. McLACHLAN: I will deal with this in a moment. I am trying to give you the history of the way things developed. I think it will help you to understand if I deal with it in that way. That scheme would develop 78 feet of head at Barnhart Island and flood out the upper end of the Cornwall Canal, the Farran's Point Canal, the Rapide Plat Canal, and, though the Galops Canal could remain if you wanted it to, it would be wise to open it up in a few places

so as to get the advantage of the natural excavations made in it for carrying water. Again, that scheme would enable a complete ice cover to form all the way from the power houses at Barnhart Island clear up the river to the foot of Galops Island, and there would be only a little open water in the deep channels that were created there. Above Butternut Island the ice cover would be continuous, as now, clear up to lake Ontario.

Hon. Mr. BEIQUE: It would be free of frazil?

Mr. McLACHLAN: Free of frazil. Then we would have no frazil formed at all and no loss of power in winter. We would, however, have a little loss of potential power at that dam in the summer, because we designed this scheme with a long dam rather than a short one, so that nobody at the long Sault could raise that level above what was intended.

Hon. Mr. LYNCH-STAUTON: Down where?

Mr. McLACHLAN: Down around the Long Sault. Nobody could raise the water level much above 238 or 239; consequently there would always have to be a drop at the upper dam. And the conception was that the structure at the upper end would let water flow out of lake Ontario uniformly from hour to hour throughout the day. Again, if a big wind blew on the lake we could meet it; you can imagine the effect of wind by looking at lake Ontario. It is a long sheet of water, and when storms come from the west, as they often do, particularly in the fall of the year and particularly with the advent of winter, big surges rise and sweep from one end to the other. The rise lasts for six hours or so.

Hon. Mr. MURPHY: What is the effect?

Mr. McLACHLAN: I want just to get the physical idea across. The effect of those storms sometimes is to raise the lower end of lake Erie about 12 feet above its normal level. There is a change in the barometric pressure, and it has the effect of lowering the water at Toledo as much as eight feet. This tilts the whole lake 20 feet. That is a thing that perhaps is not realized by many people who are not engineers. Now, lake Ontario being a deep lake, surges do not rise so high, but we have a 4-foot rise sometimes at the lower end of it quite suddenly. Now, these pulsations, as they may be described, come sweeping down the long, narrow stretch of river to Prescott. They would go right by and through Galops Rapids and on down the river, if we did not put something there to stop them. It is a curious thing, and you would not think it possible, but we know about two or three hours before these things happen that they are going to occur. That is, we know by the atmospheric pressure at different points. I have plotted them and there are some of them shown in the report, showing the atmospheric pressure at Toledo, at the end of lake Erie, and at Toronto, and then at Montreal, and you can see that these changes of barometric pressure occur three or four hours before the surge comes—in fact, before the wind comes. So we reasoned that we could make these gates adjustable enough and quick-acting enough to stop the setting up of changes in velocity and changes in the discharge below the control dam, in this scheme that was proposed, in Galops Rapids.

Hon. Mr. REID: Is that control dam a dam across the Canadian channel?

Mr. McLACHLAN: No; that is a dam across the new channel we proposed to make through Galops island, and it has a dam completely across the channels between Galops island and the American shore. It has also a dam across between Adams island and Galops island, but the stretch between Adams island and the Canadian shore only has a discharge capacity of about half the natural flow of the river, which would be, at mean flow, about 120,000 second feet. We could check it down to 120,000 second feet. We would never wish to check it below that.

Hon. Mr. LYNCH-STAUTON: Do I understand there is a dam on each side of Galops island?

Mr. McLACHLAN: In this scheme?

Hon. Mr. LYNCH-STAUTON: Yes, in this scheme.

Mr. McLACHLAN: In the scheme that I am speaking of, which was the first scheme, there would be a dam between Adams island and Galops island, and between Galops island and the American shore.

Hon. Mr. REID: At the present time the whole channel is on the Canadian side.

Mr. McLACHLAN: The navigation channel.

Hon. Mr. REID: That is what I mean.

Mr. McLACHLAN: About half the water flows out on each side of Galops island at the present time.

Hon. Mr. REID: Exactly, but I am talking about the navigation channel. It is all there?

Mr. McLACHLAN: It is on the Canadian side.

Hon. Mr. REID: The intention is to place some dams across there. According to this scheme, that would be destroyed?

Hon. Mr. LYNCH-STAUTON: No.

Mr. McLACHLAN: No, it does not really destroy it. You would still have the navigation that is now in the Canadian channel still, if you wanted to use it.

Hon. Mr. REID: Could you come down there with a vessel?

Mr. McLACHLAN: You could still come down there with vessels.

Hon. Mr. REID: Of what depth?

Mr. McLACHLAN: Fourteen feet. If you wanted to go through the locks at Cardinal or with whatever depths is in the old Galops channel now.

Hon. Mr. REID: Seventeen feet, I think.

Mr. McLACHLAN: It is hard to navigate now.

Hon. Mr. BEAUBIEN: Would it change the depth there at all?

Mr. McLACHLAN: No.

Hon. Mr. REID: It would increase it?

Mr. McLACHLAN: It would slightly increase it, yes. That was the scheme, as I say, that we thought we were going to agree on at that time. The Canadian section were quite willing to accept that, and we thought it was the best scheme available, but we found the American section would not agree to it.

Hon. Mr. LYNCH-STAUTON: Why? Did they give a reason?

Mr. McLACHLAN: They said that this loss of head in summer, up here, violates conservation principles, in that it would mean perpetually a loss of a certain amount of power; and, though we showed them that that power would cost tremendously to recover, they would not change. Perhaps I had better deal with all facts first. We could recover that power if we wanted to, even by a scheme of this kind, if we spent enough money in that stretch of river to make it sure to form an ice cover even with the highest velocity that ever could come upon it, even with a storm. Under certain conditions the surges run very high. By spending another \$20,000,000 on this stretch of river we could get that velocity so low that of course an ice cover would form right up on it; and it is conceivable also that we could have raised all these banks another five feet or so and made them so very wide that you people, or any other citizen, would have no objection to them. We certainly could do it. It would be a question of money, we figured it was not economical to do so, and we could not just see what size of structures would really be satisfactory to

hold the level of lake Ontario over such a great length, because the banks, as you see, would be fifteen miles long on one side and almost the same length on the other side of the river, and they would be earth, and it would have to be very, very solid. So we did not consider it wise to put forward a single stage scheme that would be satisfactory to our United States colleagues from a power point of view.

When we could not get the United States engineers to agree with us on that scheme we went our way to a double stage scheme and they went their way to the kind of a single stage scheme that they thought was good enough. Now, I think it is better for me not to discuss their scheme. I could do it of course.

Hon. Mr. LYNCH-STAUNTON: There is no necessity.

Mr. McLACHLAN: But I believe it would be better for me not to discuss it.

Hon. Mr. LYNCH-STAUNTON: You did not arrive at the adoption of it?

Mr. McLACHLAN: We did not adopt it.

Hon. Mr. DANDURAND: But they have not adopted yours?

Mr. McLACHLAN: They have not adopted ours.

Hon. Mr. BEAUBIEN: Would you mind answering one question? Is there any other purpose in the upper dam than to regulate the height of lake Ontario?

Mr. McLACHLAN: The primary purpose of the upper dam is to control the surges in the lake.

Hon. Mr. BEAUBIEN: They would increase the flow and cause frazil in the winter, is that it?

Mr. McLACHLAN: Their scheme would break up the ice and let it pack and it would stay there until spring. That is the point.

Hon. Mr. BEAUBIEN: In order to have one sheet of ice you reduce the flow by the upper dam, is that it?

Hon. Mr. LYNCH-STAUNTON: You reduce the surge.

Mr. McLACHLAN: You stop the surge, that is it.

Hon. Mr. BEAUBIEN: That is the purpose of the dam?

Mr. McLACHLAN: Then again, too, it protects the banks below. I mean, if we have a dam at Galops that is being operated, and we have a lock and we have men there, we are tolerably safe, no matter what would happen to any of the banks below at the Long Sault. We can hold down the flow out of lake Ontario to anything we like, and we can lower this reach 20 feet, and fix a bank, or a wall, or a lock—or do anything. We can do that if we want to. We are in a measure protected.

Hon. Mr. LYNCH-STAUNTON: For repairs.

Hon. Mr. BEAUBIEN: You cannot stop it, but you can regulate it.

Mr. McLACHLAN: But you can stop it temporarily for repairs in case of some very bad accident.

Hon. Mr. REID: Not the whole thing?

Mr. McLACHLAN: No, only down to half the natural flow of the river.

Let me see what else there is to say about that. In discussing the physical situation in this section, there is another way to control the flow out of the lake.

Hon. Mr. BEIQUE: Your special report of the Canadian section is in the appendix?

Mr. McLACHLAN: Oh, yes. If you read Appendix C you will get, I think, a very clear description of what is recommended. We really presented three plans there. We think the Chrysler Island double-stage scheme is the best.

Hon. Mr. LYNCH-STAUNTON: What scheme?

Mr. McLACHLAN: The Crysler Island scheme, we think, is really the best from the international point of view.

Our first thought, when we saw that we could not get a satisfactory single-stage scheme that we could all agree on, was to turn to a double-stage scheme.

Hon. Mr. LYNCH-STAUNTON: Would you define what you mean by "a double-stage scheme"?

Mr. McLACHLAN: A double-stage scheme is a plan whereby power is developed at two points. The double-stage scheme has a number of advantages. You of course can build the upper plant and market the power before you start constructing the lower plant, and you can get the profit on the power you sell. There might be a big difference in cost between the two schemes and yet no real difference in economy.

Hon. Mr. LYNCH-STAUNTON: No.

Mr. McLACHLAN: That is one thing. Another thing is this. We first thought of putting a dam across at the end of Ogden Island and putting a power house there that would develop a low head. It would really vary from about 11 feet in winter to 20 feet in summer, when we first built it, and afterwards about 17 feet. That would be a plant with a very low head. But, as it was at the foot of this very narrow, restricted section, it would really act almost as a valve controlling the flow out of the lake. That is, no water could get past that point if we had the dam closed, except through the water wheels. If we arranged to operate that as a base load plant, from the electrical point of view, turning out a certain amount of horse-power—say 400,000 horse-power continuously every 24 hours—and worked with some of the big companies that would have customers all over the country, we could really arrange that the flow at that point would be almost continuous for the 24 hours in the day, and if we did not want to do that we could open the gates and let the water pass through the dam. As there is no large pondage area of 25,000 acres above the dam, the surges that come down from the lake would not increase velocities in the stretch of river above Ogden Island, because there would be no pondage to fill up. We could maintain an almost steady flow in the stretch immediately above that power house, because the area was so small. Now, if we developed a head of about 17 feet at Ogden Island, that would reduce the head at Barnhart Island to about 67 feet, and that of course, would reduce the banks very greatly.

Hon. Mr. BEIQUE: It would increase the cost of maintenance because of the power house?

Mr. McLACHLAN: Yes. The first scheme would cost \$228,000,000, that is the single stage scheme.

Hon. Mr. REID: That includes power and navigation?

Mr. McLACHLAN: Yes. Then the next scheme evolved a double stage scheme estimated to cost \$264,000,000, that is for both power and navigation.

Hon. Mr. REID: What is the power alone?

Mr. McLACHLAN: That is all in the report. I would have to look it up. Navigation alone was about \$33,000,000, the rest was for power alone and common work. Now, that scheme did very little damage to the country. That is the second proposal described in the report. When we wrote the main report this is really the scheme we set up, because at that time we were still investigating a third project which I shall describe later. The virtue of the above scheme is that we could absolutely control the flow out of the lake below the power house by means of water-wheels developing power continually, and did not need to count on a spillway at all. We could open gates but the output of the power-house would control in the night.

Hon. Mr. LYNCH-STAUNTON: In this scheme have you abandoned your control above?

Mr. McLACHLAN: We have abandoned control above. A small throttling agency is still maintained above at Galops Island. Now, I want to explain what is wrong with this scheme. That scheme is fine except for one thing, when the ice cover forms in winter below Ogden Island, and also forms in winter above Ogden Island, the head goes down to about 12 feet, and there may be an extreme case where it will go down to 10½ feet, that is getting close to the limit, and it made us all feel a little nervous about it, especially in years of very low flow.

Hon. Mr. LYNCH-STAUNTON: It has quered it?

Mr. McLACHLAN: We were a little bit nervous about it. I don't say it has quered it, because we couldn't find by estimates or theory that there was anything wrong with it; but it still made us nervous, with the result that we went back to the old Crysler island site, and bored there extensively all last winter and spring, and we found that there was a good site for a dam which we had formerly missed. The reason why we missed it was because we understood that geologically you could not find sand-stone in chazy shale.

Hon. Mr. LYNCH-STAUNTON: Where is Crysler island?

Mr. McLACHLAN: Crysler island is half way between Aultsville and Morrisburg. There we found a layer of sand-stone about 12 feet in the bed of the river. It is sloping down stream. It is sand-stone of the hardest variety, we thought at first it was boulders because the geologists told us we could not get sand-stone in that geological age. But we found out they were wrong, and we did get sand-stone in the shale, and we found the two in contact, the shaly rock and the hard sand-stone; so we found, to our great satisfaction and delight last May, that there was a good site for a dam at Crysler island. The ridge of rock runs right across the river continuously from shore to shore about 38 feet below the water level and in that territory there are no boulders in the over-burden; it is a uniform mixture of sand and clay that would be first-class for our purpose. As a consequence I would say that the Crysler island scheme is a better scheme than the one we first recommended for the reason that the head is higher. It is about 25 feet in summer, and it will never drop to less than 19½ feet in winter, and the power people will much prefer that condition even if it does cost more money.

Hon. Mr. REID: How much power would it develop there?

Mr. McLACHLAN: If you built that work at the start and did not do the work below, you would get about 760,000 horse-power.

Hon. Mr. LYNCH-STAUNTON: That is at Crysler island?

Mr. McLACHLAN: At Crysler island. If, on the other hand you build the whole job at once and build the works below it, involving the raising of the water level eight or nine feet below the power-house and cut your head down to about 25 feet it reduces the power you could get to about 600,000 horse-power at Crysler island.

Hon. Mr. LYNCH-STAUNTON: This would cause damage to the country if it overflowed, wouldn't it?

Mr. McLACHLAN: Yes.

As I said the red on the plan shows the excavation intended. At Galops Island we proposed to do two things. First we propose to make an excavation right through Galops Island large enough to carry the water that now flows south of Galops Island. Then we divert the water away from all the channels south of Galops Island and improve it in the dry. After this is done we open up everything, but we maintain the dam built across the artificial channel through Galops Island. The channel south of Galops Island will run open,

and boats will use it without passing through a lock. On the north side of Adams Island, we do not propose to make any change in the natural channel.

Hon. Mr. REID: I thought you were going to make weirs.

Mr. McLACHLAN: The reason we leave the construction dam in the diversion channel at Galops in place is so as to protect us should anything happen to the Crysler island dam. Suppose we should not build a dam that would stand, and the dam should go out on us for some unexpected reason, slide out, say, it would release only the water between Crysler Island and Galops. This would raise Lake St. Francis two or three feet, and we would close the dam in the diversion channel at Galops Island, and then all that would happen would be that 330,000 cubic feet a second would flow. Such floods as these occur in nature. So the reason for proposing to leave the dam at Galops island in place permanently after we have used it for construction purposes would be that it would absolutely prevent serious floods from anything in the way of a dam bursting or anything like that. I am assuming that everything a man may build may fail, so we propose to protect ourselves even though all structures are designed to be absolutely safe.

Hon. Mr. REID: In striking a new channel at Galops Island it would probably be four or five hundred feet south of the present channel?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Is there any reason why a part could not be cut off Adams Island and leave it in the Canadian side as it is now?

Mr. McLACHLAN: It is shown where it is cheapest to build, but if you want to spend more money, and if there is any object in putting that channel on the Canadian side, you could do it. We propose to raise the water level at Iroquois about 15 feet. Galops is a long island and the channel is a free channel. We are able to get through the restriction without a lock; if it were not for the fact that the river is divided for a long distance, we would not have been able to get past without a lock and still be able to throttle the flow in the other part of the channel by a dam as is proposed.

Hon. Mr. BEAUBIEN: I do not understand very well; if you put the channel through Galop Island you will divert a part of the natural flow?

Mr. McLACHLAN: Sure.

Hon. Mr. BEAUBIEN: When you hold it, you return the flow to its natural bed.

Mr. McLACHLAN: Exactly.

Hon. Mr. BEAUBIEN: So that when you close those gaps you will not start the flow at all?

Mr. McLACHLAN: No.

Hon. Mr. BEAUBIEN: You will simply return it to its natural bed. The flow will not be diminished.

Mr. McLACHLAN: It will not be diminished. The whole object of the dam in the diversion is merely a matter of protection against the possibility of a failure of the dam below.

Hon. Mr. DANDURAND: But the argument is that the same volume of water will still flow; the water will go around the island.

Mr. McLACHLAN: Yes, but I might explain this. Nobody would ever think of closing that dam at all in the operation of those works. That dam will always stand, because the power house at Crysler Island will, for say a hundred years, regulate the flow, and all the water will pass through the power house or pass through the gates of the dam adjacent. But suppose somebody comes along, perhaps a citizen of Montreal, and asks, "What will happen if

that dam goes out?" I would have to say, "Why, 450,000 second feet would flow out of the lake." The man would say, "That is 100,000 more than ever flowed before in nature, and that will flood Valleyfield," so we have to meet that argument and do something that will insure that nothing will happen that will allow any more than 330,000 second feet to flow out of Lake Ontario under any circumstances whatever. It is far cheaper to do that than to make structures twice as large as were ever built before, just to satisfy such argument. The cheapest way to answer that argument is to provide a dam that can be closed across the artificial channel we have made for other purposes. If you figure it out hydraulically you will find that even if the Crysler Island dam goes, with the Galops Island structures closed—that is, the dam at the head of Galops Island and the dam between Adams and Galops Island, not more than 330,000 second feet can flow down the river, because the area left is not large enough to permit any more to pass.

Hon. Mr. LYNCH-STAUTON: By closing this, you are going to retard the flow?

Mr. McLACHLAN: We can do that if it is necessary.

Hon. Mr. LYNCH-STAUTON: You are talking about flooding Montreal or Valleyfield; now those dams you have on Galops Island, or these gates, will bring back the flow to what it is to-day?

Mr. McLACHLAN: What it would be under flood conditions.

Hon. Mr. LYNCH-STAUTON: What it is now?

Mr. McLACHLAN: Yes, that is it exactly. With this scheme we would have 25 feet head at Crysler Island and 60 feet head at Barnhart Island. The dam would be as before between the United States mainland and Barnhart Island, and then up the Canadian shore to the mainland just above Mille Roches, above that the natural ground is above the water level. At the head of the Cornwall canal it would be raised about 18 feet. At Aultsville it would be raised about 14 feet. It would not be raised high enough to do any damage to those villages, Aultsville and other villages. It would be below the main road at Aultsville and Farran's Point; it would be over 15 feet below at all times. Above Crysler Island there would be a pondage created of about 6,400 acres between the foot of Ogden Island and the dam. With that pondage and with the rises such as occur in surges and provided we do nothing at Galops Island there will only be an increase in flow in the 15 mile restriction of about 25,000 second feet, which is not a large amount, we can arrange to operate quite safely by discharging at that critical period when the ice is forming and backing up this stretch of river at say, 190,000 second feet, because the surge would only bring it up to 215,000, which would enable the ice cover to form quite freely. Now, this scheme, as I say, cannot possibly have any serious ice gorge in it, because the area between Ogden Island and Crysler Island is small. If we had any further misgivings as to ice gorges occurring and wish to make doubly sure we can use the dam which we leave in for emergency purposes in Galops island, this can be operated to retard those surges again, and we find by analysis that we have sufficient capacity to do so as well as time enough to put warnings into effect. So we have really got two agencies in that scheme that will enable us to keep that river free of ice and unobstructed in the winter.

There is another thing. We have the International Section improved in two stages by this scheme—about a 25 foot head developed at Crysler Island, and 60 feet at Barnhart Island. Federal agencies can take possession of the upper plants and operate them if they choose, they can allow private agencies or other bodies to build and operate the lower plants. In this way they can operate the upper plant as a base load plant and sell power uniformly 24 hours a day, in which case they can make sure the flow is continuous every day in the week

and every hour of the day. In this way we can avoid a danger that exists in the single stage scheme. That is, if you have the whole head concentrated at one plant, and you wish the people to use the water uniformly throughout the day and throughout the week—you will find it hard to force them to do that—if they comply they will have to have steam plants to take care of peaks, and they will say you are interfering with their business. In the end they will vary the flow to the annoyance of interests below. Now, if you divide it into two parts the people at the lower plant can fluctuate this pond two or three feet a day and you won't need to care; they can take care of the peak loads that occur around 4 o'clock in the afternoon by that means, and you won't need to care, the fluctuating of the pond three or four feet each day will only set up five or six inches of variations in level on lake St. Francis, and it can stand that, so you won't need to care.

Below, as I said, the dam runs across from the American mainland to the foot of the Long Sault, on to the Barnhart power-house, on to the foot of Sheek island, and up the Canadian mainland to about Moulinette, where it connects with land high enough to hold the water level of the river. There are some channel enlargements between the Canadian mainland and Croil island, but otherwise the section of the river between Chrysler island and Barnhart island is large enough to give velocities of about a foot and a half per second, and a smooth ice covering in the winter without any frazil formation whatever.

The present 14-foot boats use the main river from Morrisburg down to the Long Sault, going down; coming up, they go through a short canal at Farran's point on the Canadian side. With this scheme the cheapest place to put the canal for navigation past the Long Sault rapids and down, is on the American side of the river. At Chrysler island it really makes no difference whether you put the works on the American side or the Canadian side. The entrance works out a little neater on the American side, but so far as any difference in cost is concerned, we really could not find any difference. With the Welland canal on our side and the Quebec section on our side, we thought it would be well to show it on their side to begin with, at least.

The Committee adjourned until 8 o'clock in the evening.

EVENING SESSION

THURSDAY, 3rd May, 1928.
8 p.m.

Mr. Duncan W. McLachlan, engineer in charge St. Lawrence Waterway, Department of Railways and Canals, Ottawa, Ont., recalled:—

The Honourable C. E. Tanner, presiding.

The CHAIRMAN: We are ready, Mr. McLachlan, if you are.

Mr. McLACHLAN: Mr. Chairman, I have forgotten where we were when we stopped at one o'clock to-day. I believe I had described the various proposals which we presented to our Governments, and we were going to discuss the question of where the canals should be placed when we stopped.

Hon. Mr. DANDURAND: You had not touched the question of canalization.

Mr. McLACHLAN: I shall discuss the question of canalization now.

Hon. Mr. BEIQUE: You said you wanted ten minutes to finish on the matter of power.

Mr. McLACHLAN: Before I deal with the navigation phase, I would like to hold up this plan for a second. You have heard a great deal about surges and ice conditions, I show you here the stretch of river we have been considering. The dark blue is open water in winter. In one particular winter an ice cover formed on either side of Croil island. The light green shown areas covered over with ice. Usually the open water extends from Chimney point down to the foot of Barnhart. The ice formed in winter builds up a great jam below Barnhart island which raises the water twenty-five feet at the point where the power house will have to be located. It fills up the whole upper end of lake St. Francis from Summerstown to Cornwall thus about six billion cubic feet of ice in the jam. On the wall there is a profile of the river as it is in summer and in winter. The ice jam I speak of is shown in yellow you can see a large percentage of the natural drop in this section is really cut off with that ice jams every year. With the channel enlargement we propose, we will have none of this except just a little at Galops island.

Hon. Mr. DANDURAND: Would you say where the Americans suggest the dam—the power development?

Mr. McLACHLAN: Yes. I will show you the United States engineers' scheme as they presented it. There is the plan as they presented it. The channel for navigation crosses and recrosses the boundary. It varies from the plan which we tried so hard to get them to accept, in these respects: we propose a practically complete dam across at Galops island and also have a lock there. They have no lock at all at Galops island, though there are a few small dams across the side channels with a view to meeting that very vital need of throttling the flow if anything happened to their main dam at Barnhart island. They had to fix it so lake Ontario would not flow to the sea for a long period and run down in level, if this big dam or power-house or a bank went out. They varied also from us down at the lower end; they show a dam right across the main channel at the foot of Barnhart island practically opposite the point where we put the power-house, but they go across a different channel. We go across the north channel, north of Barnhart island, and we put the main dam above the foot of the Long Sault where the rock is at elevation 156. They propose to put their main dam across the main channel at the foot of Barnhart island where the rock is about elevation 108, about fifty feet lower than where we put it. They also propose to shorten up the side canal to a considerable extent. They wish to come right out of the level of lake Ontario level and go through a lock of forty feet lift. Now, we cannot agree to such a bold scheme as that. We lengthen out the canal and place a guard structure about the first lock, so if boats go through the first lock and carry away the gates the only trouble will be that a small quantity of water will escape from a basin and then we will fix up the gates. They think they can provide special apparatus such as swing dams and special apparatus at the lock itself that will take care of an accident at that point. We cannot accept that as sufficiently safe. I do not foresee difficulty about details at the lower end.

Hon. Mr. LYNCH-STAUNTON: I wanted to ask you where the dam goes across from Barnhart island to the main Canadian shore? I understand that the International boundary runs very close to our shore and that we only own about five per cent of the water in that channel?

Mr. McLACHLAN: That is correct. Originally about ninety per cent of the water flowed south of Barnhart island. The channel between Sheek and Barnhart islands is a fifty-fifty channel with a small flow, and this channel north of Sheek island which is in Canadian territory carried very little water.

Hon. Mr. LYNCH-STAUNTON: Such water as flows through where the proposed site is, we only own five per cent of?

Mr. McLACHLAN: That is right. Farther up the river we own ninety-five per cent of it again.

Hon. Mr. LYNCH-STAUTON: I am speaking of that territory that lies right alongside our shore.

Mr. McLACHLAN: Certainly. You are quite right. The treaty of 1909 settled that question of division of water by saying we would have equal use.

Hon. Mr. LYNCH-STAUTON: I am not speaking of our rights on the water that flows over it; but the site on which power-houses will be must necessarily be in the United States?

Mr. McLACHLAN: Not so really. We could put it on the Canadian side if we wanted to spend a little more money. It would force us into a rather awkward location. But we could push the power-house down stream and get the power-houses, Canadian and American, on our side of the line, or we could swing it so that it is half on our side. It will cost a little more; but everybody considering this matter have always assumed it would be a very easy matter in the treaty to adjust the line so that the boundary was made to go through the power-house.

Hon. Mr. LYNCH-STAUTON: If the State of New York refused to do that, how would it be if you would put the dam farther down the stream—put the dam where it would be fifty-fifty—half on our side and half on their side?

Mr. McLACHLAN: Yes, that could be done.

Hon. Mr. LYNCH-STAUTON: Would it be enormously expensive?

Mr. McLACHLAN: No, it would not be enormously expensive.

Hon. Mr. LYNCH-STAUTON: If it was down there, half the wall would be on their side and half the wall would be on our side, and half the flow would be on their side and half the flow would be on our side?

Mr. McLACHLAN: Yes. That would fit in with the American engineers' scheme. It would not fit in so well with ours if you were tying it up to the present condition of the boundary line. If you were tying it up to this you would have one half on the Canadian side and the other half on the American side.

Hon. Mr. LYNCH-STAUTON: And half of the dam would be on the American side and half would be on the Canadian side.

Mr. McLACHLAN: I think we were trying—

The CHAIRMAN: Could you designate the localities?

Mr. McLACHLAN: We are talking about the foot of Barnhart Island, and I was going to say that I think Senator Lynch-Staunton's suggested modification would be easily made in connection with the power house. In the scheme the Canadian Section presented, it would be rather difficult to meet it in connection with the dam because the dam between the head of Barnhart Island and the American shore lies wholly on the United States side of the boundary as it stands, the boundary being in this case parallel with the dam and a little above it. I never, myself, had the slightest worry over matters of that kind at the lower side—on the lower step of the development.

Hon. Mr. LYNCH-STAUTON: You mean at Barnhart Island?

Mr. McLACHLAN: On the Barnhart Island-Long Sault end.

Hon. Mr. BEIQUE: The recommendation is that the boundary line be changed—

Mr. McLACHLAN: The recommendation is that in connection with the power house—

Hon. Mr. BEIQUE: —so that it would put the power house right on the Canadian side?

Mr. McLACHLAN: Yes, so that any power unit and any people operating them will be Canadian citizens standing on Canadian soil and obeying Canadian laws.

Hon. Mr. LYNCH-STAUNTON: If you can get the boundary line changed it has the same effect, has it not, as putting it lower down?

Mr. McLACHLAN: Yes.

Hon. Mr. BEIQUE: It is a condition of your recommendation?

Mr. McLACHLAN: Yes, it is a condition of our recommendation, and it was also of the board that preceded us. It was always a condition that everybody imposed. If the other condition was laid down in our instructions we would have adjusted ourselves to it and we would have fished around with a boring machine until we got a foundation that would be suitable for a power house on the Canadian side.

Hon. Mr. LYNCH-STAUNTON: Do you think it would be out of the question to put it farther down?

Mr. McLACHLAN: No, it would not be out of the question as far as power is concerned. Now, the question has been asked why we put the navigation canal and the Long Sault dam on the American side. There are a number of reasons for that. I will tell you first of all what a fine route this is that we have on the American side for navigation. The proposal, you see, cuts off a small amount of farm land from the American mainland.

Hon. Mr. MURPHY: Was it at that point you intended giving your description of the navigation feature?

Mr. McLACHLAN: Yes. At the Galops rapids, according to the scheme we have recommended as a section, the two stage project there is no lock; but the channel south of Galops Island, down past Cardinal, is improved. The water is completely dried out by a coffer dam and then the water is put back and the coffer dam is removed. That is between the head of Galops island and Cardinal. From Cardinal down to Chrysler island it always was open river navigation, a distance of about sixteen miles. The line followed by the boats will be some times on the Canadian side of the boundary and some times on the American side. It could without much difficulty be placed entirely on the Canadian side of the boundary; but there is no object so far as any of us have thought in doing so. Once you get to Chrysler island you can put in the short piece of canal and lock required on either side of the boundary for substantially the same expenditure. The entrance and exit from the canal is a little nicer and neater made on the American side. It is also a shade shorter. At Chrysler island we overcome the twenty-five feet difference in level by the side canal and lock. For construction purposes we have to put a fourteen foot lock in the dam, because as soon as we start to build the dam we have to create some current and head that boats cannot overcome without a lock. Now, that lock is intended to be used for boats until the level is raised to within a few feet of the final level or until they can go through the new canal, and if anybody is interested it would not cost anything to make that fourteen foot lock a permanency so we would have a large and also a small canal, we could fix it so the 14 foot lock was on our side of the line.

Mr. McLENNAN: A fourteen foot draught.

Mr. McLACHLAN: Yes. Half the dam is on the Canadian side and half on the American side, one power-house is on the Canadian side and one is on the American side. Now, when you come down to the Long Sault the canal we show is six and a half miles long. It is designed to give the maximum amount of safety for navigation. Some people object to having so much canal at that point. We do not regard that as being objectionable because there is a good view and part of it is made three hundred feet wide. The canal as you see is long

and straight. It passes through a stretch of level country, marine clay, where the water level will be just a little below the natural level of the country, and through material which is easily excavated. We have good foundation for the upper lock, and, of course, for the lower lock we have the same foundation as the American Section show in their scheme. We have an opportunity to put a guard structure about a mile above the lock, and the opportunity to utilize a considerable sized basin between the two structures, so that when the lock uses its full water it only varies that pond four or five inches, and gives us a condition where, as I said before, if the gates are carried away, only a small quantity of water shown immediately above the lock goes out. And we have a good balance between that area and the area below. Even though the pond above the lock is emptied this reach can accommodate it without spilling over the banks. The scheme is to expropriate all the farm lands between that canal and the river and then, as a consequence, have no bridges. If anything is ever done with the land it will be used for pasturage purposes. I am talking of the American side. So, there will be no bridges across the land except the Ottawa & New York which must be carried across the river at the lower end.

Hon. Mr. LYNCH-STAUTON: What is the area of the land on the American side?

Mr. McLACHLAN: It just escapes me.

Hon. Mr. HUGHES: How far is the most southerly point from the river?

Mr. McLACHLAN: I think it is less than a mile.

Hon. Mr. LYNCH-STAUTON: Six miles long?

Mr. McLACHLAN: Six miles long? Something like that.

Hon. Mr. LYNCH-STAUTON: It would only be about 600 acres, wouldn't it?

Mr. McLACHLAN: It was figured out carefully anyway, and it was far cheaper than even building one highway bridge and operating it. As things develop, this was thought to be a splendid feature—to have no bridges at all. One other thing. The building of that canal enables us to leave our Cornwall canal—our fourteen foot canal—on the Canadian side intact, because for construction purposes we have to build a fourteen foot lock to take care of the gradual change in level which we bring about by our construction works, and the estimates are prepared on the basis of making that a permanency. So that boats which want to use the fourteen foot canal could go down and swing into the reach north of Sheek island, come out, and pass through the lock and enter the Cornwall canal just at lock 20 and then continue on down through the other locks on the Cornwall canal and into the river below Cornwall.

Hon. Mr. LYNCH-STAUTON: Even if we consented to put the canal on the American side we would still have the same facilities for navigation on our own side?

Mr. McLACHLAN: Yes, fourteen feet.

Hon. Mr. LYNCH-STAUTON: I mean fourteen feet.

Hon. Mr. REID: You have to build a new lock?

Mr. McLACHLAN: Yes, we have to build a new lock.

Hon. Mr. LYNCH-STAUTON: We would have the same facilities as now?

Mr. McLACHLAN: Yes. You are quite right.

Hon. Mr. REID: Only there is a new lock to be built?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUTON: I thought that canal would drown us out.

Mr. McLACHLAN: The parts above. A dam built across the river will not drown anything below it.

Hon. Mr. LYNCH-STAUNTON: How would you operate a boat above Beauharnois?

Mr. McLACHLAN: It would go straight through.

Hon. Mr. BEIQUE: Could you say if the canal was built on the Canadian side whether it would interfere with the Canadian canal?

Mr. McLACHLAN: I will show you some of the schemes we considered on the Canadian side. We have some plans showing how we laid out the canal on the Canadian side, for estimate purposes. The Canadian section, of course, were anxious to be satisfied on that point, and we searched diligently to see whether there was any way to place the canal on the Canadian side at the same cost as on the United States side, but we could not find one. I might say this. The old Board, Messrs. Wooten and Bowden, did place the canal on the Canadian side.

Hon. Mr. DANDURAND: When you speak of the canal, you speak of that canal?

Mr. McLACHLAN: Yes. They placed the canal to pass the Long Sault dam on the Canadian side. Now, one route we estimated on is as follows: It left the river above Mille Roches—it is raised eighteen feet—above the present level it passed north of the present canal between the present canal and the G. T. Railway. A lock is placed west of Cornwall and at Cornwall we designed to take away a part of the Howard Smith Paper Mills, pass between the Howard Smith Paper Mills and the river, and then go on across the present fourteen-foot canal, putting a lock just between one of the cotton mills and lock 17 at Cornwall, we pass the Long Sault as in the other canal with two locks, one of these has a lift of about twenty-seven feet and the other one forty feet or something like that. Now, the estimated cost of the canal is three and a half million dollars more than the estimated cost of the canal on the United States side. It was drawn so that we did not have any bridges, because the American Section were very strong on that feature, and we could not get them to consider anything that had many bridges on it. But an objectionable feature of the plan, besides the three and a half million dollars more of cost, was that it crossed the Cornwall canal, and would render obsolete that whole system. That seemed serious to us. Now, we considered another scheme and made another estimate. It was designed to preserve the fourteen-foot system, and it was located between the town of Cornwall and the Grand Trunk Railway. It left the foot of Bergen lake, passed between the Grand Trunk Railway and the main part of the town of Cornwall, had a lock just above the town of Cornwall, and had a lock just below the town of Cornwall. It had two bridges in Cornwall, and one just above the lower lock below the town of Cornwall. The estimated cost of that was between six and seven millions more than on the American side. We really had a third proposal. It left the river north of Moulinette, swung away north of the Grand Trunk Railway and came in again below the town. It, to, was many millions more costly than the one on the American side. So, there was nothing we could do but place the canal at that point on the American side so far as our instructions were concerned, and I really feel there is where it should be built anyway, because if we ever want to build a canal on our side we can do so.

Hon. Mr. LYNCH-STAUNTON: If you do not do away with our fourteen foot canal it seems to me it might be all right.

Hon. Mr. REID: Except in this way. Supposing the canal is built on the American side now and we have the fourteen foot canal, we have to apply and get the consent of the commission to make it twenty-five feet on our side.

Hon. Mr. LYNCH-STAUNTON: It will all be provided for when the deal is made.

Hon. Mr. REID: Of course, if we have that protected.

Mr. McLACHLAN: If you look at the map you will see that the town of Cornwall is particularly unfortunately placed for us. It is right where we would naturally want to build a canal to overcome the difference in level between the dam above and the lake below; and to make matters worse, in recent years the Howard Smith Paper Mills have been expanding at a rapid rate above the town and has covered the only area that has rock at a favourable elevation in that territory. There was at one time a finer site for a lock just north of the present Cornwall canal. It is in the yard where the Howard Smith Paper Mills now store their pulp; but, as I say, they have been gradually expanding and taking land and covering it with buildings, and now it is difficult to build a canal through that territory without removing the plant.

Hon. Mr. LYNCH-STAUNTON: Well, we are no worse off then if it is not built there if we preserve our canal.

Hon. Mr. REID: Mr. McLachlan, as I understand you, on the Canadian side if we build it at this point it would just take two locks according to the first proposal?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: And just two locks on the other side?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Now, then, the only difference is the question of cost—three and a half million dollars?

Mr. McLACHLAN: Yes, the question of cost.

Hon. Mr. REID: We would have just as good a canal on our own side?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Now, then, between Prescott and Montreal we would have entire control on the Canadian side if it wasn't just for this particular point—that is, if the locks were put on Chrysler island?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUNTON: All the way from Prescott down we are in and out of American territory.

Hon. Mr. REID: The same is true from lake Superior down. It does not make any difference.

Hon. Mr. LYNCH-STAUNTON: We are in and out of American territory. What is going to be the difference if we put that canal there as long as we preserve our other canal?

Hon. Mr. REID: I will tell you. If we have it entirely on the American side it is owned, controlled and operated by the Aluminum Company, by a private corporation. There is no doubt about that.

Hon. Mr. BELQUE: That is very important. Let Mr. McLachlan answer that.

Hon. Mr. REID: I will tell you why I make that statement. The United States Government and the State of New York have transferred in perpetuity to the Aluminum Company all the water, all the land, the whole land in that locality.

Hon. Mr. LYNCH-STAUNTON: They have transferred that to the Aluminum Company?

Hon. Mr. REID: Yes. Everything is gone. I make that statement according to the evidence before the Commission. That has been transferred. The Aluminum Company have agreed to do all the work and the treaty will be made between the United States and Canada, but the Aluminum Company

agree to stand in the position of the United States and do that free of cost to the United States.

Hon. Mr. LYNCH-STAUNTON: Do you mean to say that the United States is going to allow the title of that unit of water-power to be vested in a private company?

Hon. Mr. REID: They have vested it now. They have given the right.

Hon. Mr. BEAUBIEN: The right given by the Crown but it can be taken away from them.

Hon. Mr. REID: Never yet has the United States agreed or consented to take that back from the Aluminum Company; and besides that the United States cannot take that back except with the consent of Congress.

Hon. Mr. LYNCH-STAUNTON: They can buy it.

Hon. Mr. REID: If you can get the United States to buy that back and say that they are now in the same position as the Dominion, that they own this thing or they will agree to buy it, and, therefore, not cause any question of dispute? Does the United States government as a government have the right to decide that?

Hon. Mr. BEIQUE: Of course, that would have to be made clear.

Hon. Mr. REID: That has been put up in several investigations and so far they have refused.

Hon. Mr. LYNCH-STAUNTON: According to that, Doctor, wherever you saw this red line going into American territory it would be a privately owned canal.

Hon. Mr. REID: That is open. There is no obstruction in that.

Hon. Mr. LYNCH-STAUNTON: Mr. McLachlan, do you know anything about that?

Mr. McLACHLAN: I know that the Aluminum Company are supposed to own all of Barnhart island except two farms which they have not yet secured. So far as I know they own very little, if any, of the American mainland.

Hon. Mr. REID: They have the riparian rights.

Mr. McLACHLAN: I don't think so.

Hon. Mr. LYNCH-STAUNTON: There are no riparian rights there.

Hon. Mr. BEIQUE: This plan is based on the assumption that all that territory is purchased.

Hon. Mr. REID: Let me have it clearly understood. Mr. McLachlan can build that seven miles on the Canadian side as well as on the American side with the exception that it will cost three and a half million dollars more?

Mr. McLACHLAN: You are quite right.

Hon. Mr. REID: There is no question that we will have just as good a channel in Canadian territory for three and a half million dollars more. But if we build it on the Canadian side, then from Prescott to Montreal there would be no question at all but that the Government of Canada has absolute control; am I right?

Mr. McLACHLAN: You are right on the three and a half million more in any case.

Hon. Mr. McLENNAN: Both nations have the rights of navigation through the canal; but, the other way, all the necessary canals can be built on the Canadian side and be part of Canadian territory?

Mr. McLACHLAN: Yes.

Hon. Mr. McLENNAN: Whatever the diversion of water power may be?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUTON: I do not see any objection to that being done there and preserve ours. What difference does it make whether that canal goes through American territory or not?

Mr. McLACHLAN: Now, I think we have covered the International Section.

Hon. Mr. REID: I would like to ask a question. According to your report, if we take into consideration navigation only, as I understand it, from Prescott to Montreal in the International section, you would say it would take \$8,732,000 on the upper pool and on the lower pool \$25,618,000, or \$34,350,000 altogether. Can you give us this through the International Section for navigation only?

Mr. McLACHLAN: No. I am glad you brought that point out because I was almost forgetting it. That 34 million you spoke of covers just a side canal at Crysler Island and the side canal from above the Long Sault dam to below Cornwall along with a few excavations of the river just above and below where there is no enlargement needed for power. That makes that 34 million. Now, we were asked, according to our instructions, a certain number of questions. That was done because of our experience on the Trent and other places where we executed river improvements. When you get to the question of allocating what is properly chargeable to power and navigation according to our constitution as I understand it, lawyers also ask the question: What would you have done if there were no navigation and you had to improve for power, and conversely what for navigation alone if no power; and the third question, of course is. What if you wanted to improve for both? Now, we were asked the question: what would it cost to improve for navigation only. We laid out a scheme for improving this section for navigation only. It is estimated at 79 million dollars; and this is the kind of scheme it is.

Hon. Mr. REID: Is that for navigation?

Mr. McLACHLAN: For navigation alone. Now, this is the International Rapids Section. According to that scheme we build a side canal from above Galops island, following the American shore, sometimes dyking it sometimes cutting through hollows fifteen miles down to Waddington where we put a lock of fifteen to twenty-five feet, in the river below. We build a dam across the head of the Long Sault rapids and we build a short canal. It was actually designed to accommodate itself to a level of 220 which is three feet higher than the lower pool in the Crysler Island scheme. With the water raised about twenty-two feet above the Cornwall canal we were able to navigate without much excavation from Waddington down to the Long Sault. At the Long Sault there was a side canal to lake St. Francis. That was estimated at 79 millions. It would, of course, have enabled a head of about 63 feet to be developed whenever required at the Long Sault rapids, and it would have left the river between the Galops rapids and Morrisburg in the position it is in to-day as far as rapids are concerned and so far as ice formation is concerned. But every winter, opposite Morrisburg it would raise possibly fifteen feet, and an ice jam would form from Croil Island clear up to that point which would melt out in the spring like the ice jam melts out at the head of lake St. Louis every spring and simply hold up navigation, and in that way it would do quite a lot of damage to the town of Morrisburg and some to Iroquois. But so far as navigation is concerned—if we are not concerned with power that would be the best way to get a twenty-five foot channel that would be workable. If we did not want to change the river at all, and wanted to get a canal for navigation alone. We could build a canal for navigation alone that would leave the river at Chimney point and follow down the Canadian shore always travelling along parallel with the Grand Trunk Railway to below Cornwall, we could build such a canal for 100 million dollars. We would, of course, have to take a little additional water out to take care of lockage as we do in the Welland. That is for twenty-five foot depth.

Hon. Mr. HUGHES: Mr. McLachlan, the statement was made in the Senate a few days ago that small canals were better commercial propositions than large canals. That statement was made by an engineer?

Mr. McLACHLAN: I am quite willing to give you the information although I think it would be better not to bring it in here.

Hon. Mr. REID: As I understand, Mr. McLachlan, that is the second proposition; that is the Canadian proposition—two sections. Take them from the head, from where it starts down to Crysler island and a lock put on the Canadian side instead of on the American side, or have two locks if you say, and then go on down shore to the head of the Cornwall canal and through on the Canadian side according to your report, and I want to know if I understand it rightly. The cost would be \$34,350,000, plus three and a half million dollars?

Mr. McLACHLAN: In addition to the common and power works, yes.

Hon. Mr. REID: Absolutely. And we would have it all—at least the control, because we cannot call it a Canadian channel all the way, because we go forwards and backwards on the American side. Now, if I understand that rightly it amounts roughly to 38 million dollars and we have it all on the Canadian side.

Hon. Mr. MURPHY: Does that apply just to navigation?

Hon. Mr. REID: That is navigation. But the Americans would refund us half the cost of the Crysler island dam, wouldn't they?

Mr. McLACHLAN: You are getting into deeper water than I want to enter when you ask me what is going to be done.

Hon. Mr. DANDURAND: If Canada decided to pay 100 million dollars to build a canal parallel with the Grand Trunk Railway, could not the Americans say, "Allright, you go on and we will build our canal ourselves"?

Hon. Mr. REID: Now, we are not talking about 100 million dollars. Now, Senator Dandurand, don't let the Committee think I am advocating 100 million dollars. I am trying to build exactly as Mr. McLachlan suggests. Therefore, even if they did not pay it \$37,500,000 would build that reach there.

Hon. Mr. BEAUBIEN: The same depth?

Hon. Mr. REID: Twenty-five feet. And if that were done we would have 460,000 horse-power developed at Crysler?

Mr. McLACHLAN: 300,000 h.p.

Hon. Mr. REID: We would have that as well as the navigation on our own side. Then, when we come to this other point at Barnhart island we could develop 200,000; am I right in that estimate on our Canadian side?

Mr. McLACHLAN: You can develop far more than that.

Hon. Mr. REID: Well, you can develop far more than that. Now, the position I take is this: At Crysler island where the total cost of the dam right across will be 37 millions, it will give to the Americans 460,000 horse-power as well as our side; and, therefore, there is not any doubt but that the Aluminum Company would pay the half of that dam when they get 460,000 horse-power. For this reason: to carry out that scheme of \$37,500,000 that would be 660,000 horse-power at the least—Mr. McLachlan says more—we would have 660,000 horse-power on the Canadian side, plus the canal and control on our own side, and 460,000 horse-power on the American side. Now, the cost of that on our own side for the 660,000 horse-power would be \$37,500,000 with no power on the other side if they did not pay for the 460,000. Now, you can see that 660,000 horse-power would only cost us about seventy dollars a horse-power to do all the work for the 660,000, plus the canal. The Americans, of course, if they only paid the half of the dam and refused to pay any of the other would only get 460,000 horse-power. They would pay half the cost of the dam which would be \$34,000,000. Now, if I am right, it would leave Ontario—I am speaking

now of Ontario and Quebec—it would leave Ontario in this position that when the work was done with the canal on our own side, with the Dominion having the absolute control of its navigation as it has to-day, it would have 660,000 horse-power on our side of the river plus the canal. And plus this: At Beauharnois there is to be two million horse-power developed and we would have half of that if we needed it in Ontario, or we stand with the same 660,000 horse-power right in Ontario with the absolute control of navigation and all power?

Mr. McLACHLAN: I could not follow Doctor Reid. I am confused.

Hon. Mr. BEIQUE: Let me ask a general question on that as to whether it would mean a material diversion of water entailing the consent of the United States Government—the scheme as suggested?

Mr. McLACHLAN: I don't know that I follow Senator Reid's scheme. I think what he means is supposing we built the dam at Crysler Island.

Hon. Mr. REID: There are only the two points, and one is Crysler Island. It does not make any difference. Now, what Senator Beique means is this: If you deepen and enlarge the Cornwall canal on our Canadian side does it make any diversion of water?

Mr. McLACHLAN: The stretch of river between Crysler Island and Long Sault is a stretch that is fairly flat. There is only a fall of seven and a half feet in its length. At the lower end it flows over a rocky ridge which runs across the country. Now, it seems to me Senator Reid has this kind of an idea: He proposes to develop the upper part at Crysler Island with a dam and power house. At the lower end he proposes to build a side canal and divert water out of the river above the Long Sault controls and get all the power you can by using the channel north of Sheek Island.

Hon. Mr. REID: Just the same as the Americans.

Mr. McLACHLAN: Of course, you cannot take water out of a pond which is controlled by a natural weir without effecting its level, and if you take water and effect its level then you must go to the International Joint Commission for approval. So you are not very well off.

Hon. Mr. LYNCH-STAUTON: If the channel is not navigable now?

Mr. McLACHLAN: It is navigable—the fourteen feet. The fourteen feet boats travel that now.

Hon. Mr. LYNCH-STAUTON: Yes, of course they do.

Mr. McLACHLAN: And the seven foot boats go down the rapids. The American shore is north of Barnhart Island. You cannot take water out of the river above the rapids without going to the Commission.

Hon. Mr. REID: Don't we have to do the same thing when we are going to divert that canal to the American side?

Hon. Mr. BEIQUE: It has to have the consent of both parties.

Mr. McLACHLAN: The canal as laid out is associated with a temporary dam.

Hon. Mr. LYNCH-STAUTON: I have been told that if you put your dam at the foot of Ogden Island instead of Crysler Island that the result would be that you would not flood out the land on the Canadian side below Ogden Island?

Mr. McLACHLAN: Quite right.

Hon. Mr. LYNCH-STAUTON: Now, I would like to know what is the objection to putting it there instead of putting it at Crysler Island?

Mr. McLACHLAN: I explained that this morning. You will have a head that will never get less than 19½ feet at Crysler Island whereas if we move to Ogden Island the head comes down to 11 feet in winter.

Hon. Mr. LYNCH-STAUTON: That is your reason?

Mr. McLACHLAN: Yes. Now, when heads go down to that, power people get pretty nervous because it is hard to keep up the speed on the generators unless they are very small, and a loss of six inches in 11 feet means a great loss of power whereas six inches of loss in 19½ in winter does not make much difference. Now, the back part of the town of Morrisburg—is built on land which is well above Lake Ontario. There is a certain business section that is low, that is down within about two feet of the water level that we propose in the river. That, consequently, will have to be dealt with. Now, in figuring on this Crysler Island scheme we did this: we first provided for a dyke around Morrisburg, at an estimated cost of six or seven hundred thousand dollars. We knew the town of Morrisburg would never be satisfied with such a solution, we knew no one would be satisfied with placing the citizens of Morrisburg behind a dyke where they would have to depend on a pump to keep out drainage and care for leaks. On the other hand, we did not want to put a large sum in our estimates and say this should be paid to the town of Morrisburg to knock down that part of the town and rebuild and put it nearer the Grand Trunk Railway, or up-stream because the property in that part of the town is not worth as much as the damages that should be paid. So we set about to design better protection and drainage works. We then figured on an egg-shape sewer that is big enough to carry off the drainage for the whole town, and we figured on building that sewer back of this bank all the way down to below that dam at Crysler Island. That cost is about \$1,800,000 and we put that in the estimate. It is in the estimated cost of the Crysler Island project so if this scheme is executed it would have gravity drainage. With it the town of Morrisburg is in a first-class position to say "Give us the money and we will knock down all that part of the town and we will move it up the hill and everybody will be happy. I grant this method of dealing with Morrisburg has boosted the estimated cost of this scheme and possibly better arrangements can be made than the estimate indicates.

Hon. Mr. LYNCH-STAUTON: Your objection to putting the dam at Ogden Island is simply this, you are satisfied you can develop more power below?

Mr. McLACHLAN: Yes.

Hon. Mr. LYNCH-STAUTON: That is the reason?

Mr. McLACHLAN: Yes. A little better protection. We are on safer ground.

Hon. Mr. LYNCH-STAUTON: Is not it a very serious thing to drown out all that land?

Mr. McLACHLAN: Well—

Hon. Mr. LYNCH-STAUTON: A couple of thousand people live in there.

Mr. McLACHLAN: No. Not in that stretch. There is the town of Morrisburg. The populations are given in our report.

Hon. Mr. LYNCH-STAUTON: No, but I mean the country people. You are going to form another lake up there, are you not?

Mr. McLACHLAN: I forget the area. I don't think there would be a thousand acres below Morrisburg on the Canadian side outside of the islands.

Hon. Mr. LYNCH-STAUTON: That would be effected?

Mr. McLACHLAN: Yes. We build the dyke so as to terminate the flooded land. We actually proposed to re-locate the Grand Trunk Railway and terminate the flooded area by a dyke. There will be no swamp.

Hon. Mr. LYNCH-STAUTON: If you did not build the dyke and gave them the money where would your swamp lands extend?

Mr. McLACHLAN: We would certainly build the dyke, and would terminate the flooded area, so we would have no swamp land. That country is absolutely

flat, and there is a ditch provided for back of that bank, and the bank is only a few feet high, and it is put there to terminate the land that would be wet and dry with changes of level.

Hon. Mr. LYNCH-STAUNTON: Won't the water seep under and come up on the other side and make a swamp?

Mr. McLACHLAN: Not if there is only a couple of feet head. We can arrange what head we like. We do not need to put that dyke there at all. We can carry our bank straight north of Crysler Island and hit high land and leave a natural shore to form, but on account of the fact that water levels will rise and fall we thought it would be better to terminate that flooding; we thought it would be a nicer solution from a scenic point of view to build a bank and put a ditch behind it, as you have above Iroquois now.

Hon. Mr. REID: As I understand it a boat can leave Port Arthur to-day and go through to Montreal, and there is no objection to her at any point. She can go through without obstruction in Canadian territory?

Hon. Mr. LYNCH-STAUNTON: No, you can't; you go through American territory.

Hon. Mr. REID: Without obstruction.

Mr. McLACHLAN: What Senator Reid has in his mind is he wants a project laid down from the head of Lake Superior to Montreal so that he will have all locks in Canadian territory.

Hon. Mr. REID: Just as we are to-day. I want to have it in the same position as it is to-day.

Hon. Mr. LYNCH-STAUNTON: Wherever you go ashore you will be on Canadian territory?

Hon. Mr. REID: Wherever you lock through it will be on Canadian territory. Now, then, if this scheme is carried out, as it is proposed, then there would be two places that we would need to go through American locks. That is at Crysler Island. That is one place. Now, Mr. McLachlan says you could just as well put that on the Canadian side where it is to-day. That then leaves a boat to come through from Port Arthur to Montreal and all locks she would go through would be on Canadian territory where we have control, except at this point we are discussing of seven and a half miles. Now, when we come to that point, if the decision of the commission was that we build it on the Canadian side, according to Mr. McLachlan, as I understand him, we can get just as good a channel and that seven and a half miles could be put on the Canadian side, and the only point is that it would cost three and a half million dollars more.

Mr. McLACHLAN: You are quite right.

Hon. Mr. REID: Therefore, if we spend three and a half million dollars more that would then be all Canadian; at least, the channel from Port Arthur to Montreal that we go through would be partly American and partly Canadian; but when we come to places of obstruction the lock is on our own Canadian side, and in that way we control canal navigation and the levels of the water—that is between Prescott and Montreal. First at Crysler Island we control it and then we control it at Barnhart Island. Am I right?

Hon. Mr. LYNCH-STAUNTON: The control is very important, I think.

Mr. McLACHLAN: Now, I think we have covered the International Rapids section pretty well.

Hon. Mr. REID: Am I right in that last statement?

Hon. Mr. LYNCH-STAUNTON: Wait until you read it and give us your answer then.

Mr. McLACHLAN: Yes, I would like to do that.

Hon. Mr. DANDURAND: Is it clear that we would control at the second dam?

Mr. McLACHLAN: The final dam across the main river as laid out at the foot of this section is in American territory because it runs from Barnhart Island which is United States territory to Long Sault Island and the mainland on the south side, all of which is United States territory; but we could build a dam a little farther up where three-quarters of the dam would be in Canadian territory, if we built that dam up at the crossing of the rapids.

Hon. Mr. LYNCH-STANTON: For what purpose?

Mr. McLACHLAN: For navigation alone, as Senator Reid has mentioned. We could have three-quarters of the dam on the Canadian side of the boundary, if that is going to do anybody any good.

Hon. Mr. LYNCH-STANTON: Well, is it?

Mr. McLACHLAN: I don't think so, but we could build it there, and, having the gates on our side of the line, of course we could control it largely if we had nearly all the gates on our side. But what would happen would be this: If we did that and then tried to develop power naturally we would have to excavate a head race from north of Sheek Island down to a power house at Barnhart Island. It would be more costly than using the natural channel which is there now between Sheek and Barnhart Islands, and it would be throwing away a section of river which is quite large enough and would put ourselves in a position where we would have to excavate a new channel.

Hon. Mr. LYNCH-STANTON: What Dr. Reid is saying is that you do not do anything with this Barnhart Island business at all. He says he wants only to develop this six or seven hundred thousand and let this international development go. That is what he is after.

Mr. McLACHLAN: As a matter of fact, the Crysler Island project is laid out with that idea if you want to adopt it temporarily. You will find it on page 392A. You can build all the works above the Long Sault along with a side canal and part of the final dam at Long Sault Island along with a temporary dam on the rim of the Long Sault Rapids. These works will enable you to raise the water to elevation 217, and go on with the navigation to Lake St. Francis. Now, Senator Reid, as I understand him, suggests that we stop there, except that he says we will—we might develop 200,000 horse-power by building a side canal around through Canadian territory and building a power house at the foot of Sheek Island or some such place, and let it go at that. But that United States officials with whom I have been in contact, of course, would never agree to anything that did not develop all the power in the river if it can be done so they would not agree to Senator Reid's proposal.

Hon. Mr. LYNCH-STANTON: Crysler Island lies between the state of New York and the province of Ontario?

Mr. McLACHLAN: Crysler Island, itself, is an American island.

Hon. Mr. LYNCH-STANTON: It is between Ontario and the United States?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Mr. McLachlan, Senator Lynch-Staunton was right in what he suggested, and that was this: If you go down with the channel on the Canadian side, then if you do not put that dam at the Long Sault you have 660,000 on our side and they have 660,000 horse-power on their side. I want to prevent any possibility of ever interfering with Montreal harbour or the power in the province of Quebec because the dam is not there right across.

Mr. McLACHLAN: No, I don't agree with that.

Hon. Mr. REID: We have the control of it if we build it on our own side.

Mr. McLACHLAN: Anything that would pass Crysler Island has to go on to Montreal; nobody can stop it.

Hon. Mr. REID: The dam at the Long Sault would be under the control of the American side; they would have the control instead of us if your dam was right across.

Mr. McLACHLAN: No, I don't agree with that. The pondage between Crysler Island and the Long Sault is so small that it would be only half an hour or so before any additional water let in at Crysler Island would rise and go over the dam. That is the whole strength of chopping up this International Scheme into two parts; you keep rigid control of the developments. You control the flow at Crysler Island. You could lease all the water at Barnhart Island to Chicago and they could not do you any harm below lake St. Francis.

Hon. Mr. REID: Of course, the position I take is have it on the Canadian side if you can because it leaves the power with us. I will not discuss that now.

Mr. McLACHLAN: That is my view of the matter. It seems to me Senator Reid's view might be made practical if he would suggest a dam just above lock 19, with U.S. power house south of Massena point and canal for navigation on the Canadian side. At this point we have a fair foundation and enough room on our side of the line to get in our power house and half of the gates required at a dam, diverting half the flow south of Massena point would help in the entrance lock at Cornwall. I hardly think I need discuss the lake St. Francis section in detail. It is a stretch of lake with a six inch drop and a small amount of excavation in a few places.

The CHAIRMAN: Say where it is.

Mr. McLACHLAN: It covers the thirty miles of Lake St. Francis.

Hon. Mr. MURPHY: From where to where?

Mr. McLACHLAN: From St. Regis to Coteau. The south side of Lake St. Francis is entirely in the Province of Quebec; the north side is half in the Province of Ontario and half in the Province of Quebec, and the American shore touches the lake just at the upper end. At the upper end of the lake as you know the boundary leaves the river and follows along the 45th parallel of latitude over to the State of Maine. Below the Lake St. Francis section we come to the Soulanges section which is about eighteen miles long and in it the river has a drop of about 82 feet in 14 miles. I have already described to you the falls and rapids in the Soulanges section. The country on the south side of the Soulanges section is very flat and level. On the south side of the river it is a little lower than on the north side—the general level of the country. Starting from Hungry Bay and swinging around to the head of Lake St. Louis is flat and generally a few feet below the level of the lake. At the Lake St. Francis end of this flat country a little artificial canal for diverting water was built in the old seigniorial days from Lake St. Francis to the St. Louis river. You will notice on the north side of the river there are three small rivers, one of them is quite long and comes into the St. Lawrence just below Coteau rapids and above the Cedars. Those rivers are the Delisle, Rouge and the à la Graissee. On the south side there are no tributary streams entering the river. All the country between Lake St. Francis and Lake St. Louis is flat as a rule and slopes to the south. Col. Wooten and Mr. Bowden who preceded our Board in the investigation of this matter recommended a side canal for navigation between these two points, and they recommended leaving the development of power in this section for the future. What we recommend is shown in a diagram. The canal formally proposed runs from Hungry Bay at the foot of Lake St. Francis to Melocheville at the head of Lake St. Francis, it swings south of Valleyfield three miles into the bend and passes about its middle, close to the St. Louis river. At the upper end there was a guard lock, at the lower end were two locks in flight, so that the whole drop was overcome at one point at the entrance to Lake St. Louis. The canal was to be excavated to a width

of 200 feet on the bottom, but it was thought that in connection with such a long stretch of inland navigation it was best to provide for possible widening to 400 feet should boats require it so the banks were placed about 500 feet apart. That canal was estimated at about 33 million dollars, and our estimate for such a canal is just about the same. When we were appointed we were asked questions somewhat different from our predecessors. We were not asked to simply say what should be built for navigation, but we were asked two other questions, viz: How should the river be improved for power? How should it be improved for navigation only? How should it be improved for the combined necessities of both power and navigation?

Hon. Mr. BEIQUE: The other recommendation was merely for navigation?

Mr. McLACHLAN: Development simply for navigation. It included power too if they chose to do so.

Hon. Mr. BEIQUE: No, but their estimate was for what?

Mr. McLACHLAN: Their estimate was for navigation alone. Now, when we came to investigate this matter—

Hon. Mr. MURPHY: What was the drop at Lake St. Louis?

Mr. McLACHLAN: Eighty-two feet. When we started in to investigate this matter we had to go into the river and make a lot of borings to determine how the river could be improved for power. And our first problem was associated with that problem because we knew quite well we could build this canal for a small sum of money for navigation alone. Well, we bored in the river and in the rapids—and fortunately we were able to get a good site for a dam just above Cedars, and after setting up all kinds of schemes for the improvement of the river for power we finally decided that the best way to improve it was to divide it up into three stages. Each stage of which could be built in succession one after the other with the first stage a dam across the river just above Cedars was required and it is also proposed to develop 400,000 horsepower at the 22 foot head at that point.

Hon. Mr. MURPHY: Is that proposed dam above the Cedars rapids?

Mr. McLACHLAN: It is above the present Cedars rapids two and a half miles. Now that would have to be associated with some excavation at the Coteau rapids because Coteau rapids were not large enough to carry the water at a sufficiently flat slope, and they were not large enough to reduce ice covers to the point we thought was necessary. So we had to spend eight or ten million dollars in channel enlargement on the south side of the Coteau rapids in order to flatten them and in order to reduce the surface area open in winter. This new diversion channel was designed so the sides would be smooth, and so the water would run very fast through it in winter. It was arranged however that this water in the river itself would travel very slowly and would freeze over in many places. That proposal was also associated with an embankment which runs along the north side of the river from Coteau du Lac to Cedars to retain the head. The proposal also required provision for caring for fourteen foot navigation until a deep waterway might be built. That meant we had to join the raised pond to the present Soulanges canal with a lock, and we had to arrange for a connection with the Soulanges canal up near Coteau du Lac to pass the Coteau Rapids even after improvement for power. It also involved the draining of part of the low country along the Delisle, Rouge and à la Grosse rivers, and the best way we found to do this was to use the old Soulanges canal as a drainage ditch after fourteen foot boats were switched into the river. It is a very complicated project to describe, and I know it is hard for you to understand. In order to drain the country effectively, we reduced the area that would have to be cared for by the abandoned Soulanges as much as possible,

so we proposed to tap the Delisle river above Coteau Landing and carry it into Lake St. Francis at a point where the natural level is above Lake St. Francis. This leaves the areas east as the only ones to be cared for by the old canal.

The second stage of the improvement proposed consists of diverting 67,000 second feet overland from the pool above Cedars village to the Ottawa arm of Lake St. Louis, thereby developing 500,000 horsepower at 78 foot head.

Hon. Mr. ROBERTSON: At what point?

Mr. McLACHLAN: Just north of Cascades Point. Now, the third stage, which, of course, would not be made until all the power was marketed consisted in building a dam across the river at Cascades Island and a power house between Cascades Island and Cascades Point, at this point 54 foot head would be developed. That would raise the water in the reach above so it would form an ice cover almost up to the upper plant. It would do some damage to the lower parts of St. Timothee. Now, that is what we recommend as being the best for power. Now having decided that question we turned to navigation. Should improvement for navigation be required at the same time, as the first stage of the power development is required. Should they be combined? Well, after very very careful investigation, we found that there was an apparent economy of about 8,000,000 dollars in combining them. That is, instead of building a canal for navigation alone around the south side of the section overland—a fifteen mile overland canal—it would be eight million dollars cheaper to build a side canal on the north side at Coteau Rapids, which would have a very low lock above the mouth of the Delisle river and a side canal from Cedars Village to the Ottawa Arm of Lake St. Louis. And that is what we recommended as the answer to the first question as to how best that section could be improved. I have a plan which shows the recommendation, it includes the first stage of the power development and the works for navigation. The federal government could develop 400,000 horsepower above the Cedars, and then leave to other agencies, Provincial agencies, or people licensed, freedom to go on and develop the other two stages of the power development as they want them. There would be no reason for developing any more of our power than that in order to get the best navigation.

After we had dealt with the above questions, we turned to the other questions. We were asked how the river should be improved for navigation alone. Well, as you will see by reading the report, the Canadian section said it would not be reasonable to execute all the works that are shown in this section and not put in that power house or develop the 400,000 horsepower at Cedars. It would mean the Federal Government would be spending about seventy million dollars for navigation work whereas we could build a side canal that would be good enough for navigation for about 33 million dollars. As a consequence, the Canadian section put a rider to their recommendation to the effect that unless an agreement was made in advance for the leasing of that power at a reasonable rate we, as a section, recommended that the Federal Government keep out of the power business in this section and build a side canal for navigation alone.

The American Section, on the other hand, would not agree to that. They said, "No, we are strong for river navigation and we want the best navigation we can get from Lake Ontario to the sea, we would prefer to see this scheme executed as shown even though no power houses or no machinery are put into those power houses." To keep in the river even though it does cost a great deal more money, and, if that was not acceptable presumably to Canada, they would prefer to build a side canal on the north side of the river closely approximating the Soulanges canal and located so it could come into the river at a future time when the power agencies, presumably licensed by the province, would make the development in the river.

Now, in considering all these schemes we set up a great many other propositions, in fact, a half dozen other kinds of river developments, we chopped the developments up into several stages and we analysed all such schemes on the basis of marketing power at different rates, because we could easily lay down a scheme that would be ten million dollars cheaper than the one I described for power alone, but it would be cheaper only if we had a market for all the power as soon as the works were completed but when we figured overhead charges on what we had to spend for the first stage and overhead charges on the second until the power was marketed. They were not cheaper but more expensive.

When we were considering improving the river for navigation alone from Hungry Bay to Melocheville by a side canal we tried to meet the objection to the long stretch, of 14 miles of narrow canal by making it wider with a small diversion for power in the canal, we made estimates for improving the river by first building a side canal through the territory from Hungry Bay to Melocheville with a width of 300 feet and a 15,000 second feet, diversion for power. Then we also tried making the canal 430 feet wide on the bottom and diverting 30,000 second feet always figuring also the later expenditures which would be required to develop the remaining resources in the river. These schemes were found to be slightly more costly than the project recommended.

We also considered making a canal wide enough to divert the full flow that was contemplated in our second stage, 67,000 second feet, and later on going into the river and making a development of 400,000 horse-power above the Cedars, and about a million horse-power at Cascades Island, as shown. I have that particular kind of plan drawn up. If we adopted a scheme like that it would be a workman-like job in this way: we would cut up the country on the south considerably by a long canal but we would save the building of any power works from Cedars to Cascades. We would leave the country there as it is. The Soulanges canal which drains the country to the north could discharge right into the river direct at the provincial plant.

Hon. Mr. DANDURAND: That would eliminate the Soulanges canal?

Mr. McLACHLAN: That would eliminate the Soulanges canal. The new deep 25-foot navigation and also the 14-foot boats would temporarily pass down the new canal, and lock down into the head of Lake St. Louis in two locks in flight.

Hon. Mr. BEIQUE: Would that reduce the depth of water in the river?

Mr. McLACHLAN: Yes. If we improved the river by this kind of scheme and diverted 67,000 second feet around Melocheville and developed power there, you would have to build a compensating work in the Coteau Rapids to hold up the level of the lake. With this scheme executed, it would reduce the levels in the river all the way down from the rapids to Lake St. Louis and that would prevent the passenger boats running the rapids any more. That would be a feature of that scheme.

We found that improvement, to be quite workman-like and it is simpler than what we recommend. It does not require the team play that our recommendation requires between the various organizations developing power and other who give power rights and control navigation. It is however, eight or ten million dollars more expensive than what we recommend so far as we can see. That deduction is modified to a certain extent by the unit prices for excavation. Some people think that the unit prices we used, in all the work were too high. Some contractors say our unit prices for excavation of earth without any stones in it are fifty per cent too high.

Hon. Mr. McLENNAN: What is the difference between these two schemes from the standpoint of navigation?

Mr. McLACHLAN: The difference is half an hour. We figured at the time these schemes were considered that a boat would pass through the section half an hour faster via the river than via the overland canal scheme on the south side.

Hon. Mr. BEIQUE: You would not have to obtain the consent of the American government?

Hon. Mr. REID: Oh, yes.

Mr. McLACHLAN: It is a constitutional question as to whether we have to get the consent of the American government for anything we do in the Quebec section or not. I think you are better able to deal with that than I am.

Hon. Mr. BEIQUE: It would entail no diversion of water from the river.

Mr. McLACHLAN: The recommended scheme involves——

Hon. Mr. REID: No diversion from the river?

Hon. Mr. BEIQUE: That is what I say.

Mr. McLACHLAN: The scheme for improving this section means the destruction of the old seven-foot navigation in the river. We have never thought it was necessary to try to perpetuate the river navigation for the seven-foot boats. We always assumed that they would go by the boards some day.

Hon. Mr. REID: With reference to that question that Senator Beique raised. He said that it would not be necessary to require the consent of the American government for these works that you just mentioned.

Hon. Mr. BEIQUE: The one recommended.

Hon. Mr. REID: Any works done in Quebec. One thing I wanted to say was that the Cedar Rapids Power Company work—was all work done in the province of Quebec. They got a charter from the Quebec government and then at the request of the Minister of Public Works it was inquired into by the Waterways Commission. They had three meetings, that is the American and Canadian sections jointly, and it was after these meetings that the work was proceeded with and approved by the Department of Public Works.

Hon. Mr. BEIQUE: The case was they were diverting water from the main channel.

Hon. Mr. REID: I don't think so.

Hon. Mr. MURPHY: As shown on that plan the proposed canal runs from Hunger Bay to Lake St. Louis overland?

Mr. McLACHLAN: Yes, overland.

Hon. Mr. MURPHY: What is the length?

Mr. McLACHLAN: Fifteen miles.

Hon. Mr. MURPHY: What is the width?

Mr. McLACHLAN: One thousand feet in some places, 27 feet deep.

Hon. Mr. MURPHY: As shown on your plan, does that run through the same territory as the Beauharnois Light and Power Company who have authority to build a canal from the Quebec legislature?

Mr. McLACHLAN: Yes, through the same territory. And the same kind of scheme except that they have the right to divert about 40,000 second feet. I don't know whether that is average flow or maximum flow or minimum flow. The plans we prepared contemplated in one case 67,000 and in another case 30,000 second feet diversion. We haven't got a scheme worked out that fits in with what they have a right to do.

Hon. Mr. DANDURAND: You say that this last canal would call for compensating work?

Mr. McLACHLAN: Yes, compensating work on the rapids to hold up Lake St. Francis. The extent of that compensating work depends on the extent of

the diversion. If a scheme like the Beauharnois scheme were executed it would, of course, lower the head at Cedars a certain amount; the water level at Cedars would go down at the head and at the foot. We have never figured on compensating works for the Cedars, but no doubt something would have to be done.

Hon. Mr. MURPHY: That is not the one shown on the lower plan that you have recommended?

Mr. McLACHLAN: No. If a plan like that was executed, I think something should be done to help out the Cedars plants temporarily.

Hon. Mr. MURPHY: You recommended the other plan?

Mr. McLACHLAN: Yes, we recommended the other plan. We had to do it for reasons of economy.

Hon. Mr. DANDURAND: To what extent does your plan affect the Cedars?

Mr. McLACHLAN: We affect them in the third stage. In the first stage it is supposed to be built without affecting them at all. We first build a power house at Isle aux Vaches, and once that is built enough water can be passed through it to supply the Cedars plant. Then the channel between the north end of that power house and Cedars village is coffer dammed—then a dam is to be built—then after the work is finished the Cedars Rapids plant will get its power either from the dam above it or from the gates that are in the dam adjacent to it. Then the second stage would be completed also without interfering with the Cedars plant because it is an overland canal connecting the pool above the dam and the Ottawa arm of Lake St. Louis. The third stage which involves building a dam below the Cedars plant will, of course, flood out the Cedars plant, and just as soon as the third stage is built and the water raised the machinery must be taken out of the Cedars plant and the plant removed, because we are designed to use the head race of the Cedars plant to carry water through the restricted part of the river above and below Cedars.

Hon. Mr. MURPHY: Do I understand you to say that not one of these plans already prepared could be carried out without prejudicial effect to the Cedars Rapids people?

Mr. McLACHLAN: The plan we recommend would not endanger the Cedars Rapids people at all until the third stage is reached. It is assumed that the first two stages can be built without affecting them at all; that is, without affecting their big plant. There is a little plant.

Hon. Mr. MURPHY: I meant the big plant?

Mr. McLACHLAN: No. The third stage would put them completely out of business. It is a fact that the Cedars plant has some day to be thrown into discard. It is a plant costing twenty-five or twenty-eight million dollars. We have not been able to develop any plan for improving the Soulanges section that does not require the scrapping to the Cedars plant. It is a terrible catastrophe in the sense that so much money should be invested in a place that we cannot save.

Hon. Mr. LYNCH-STAUTON: Is that for navigation purposes?

Mr. McLACHLAN: No, that is for power. We do not have to do that for navigation purposes. As far as navigation purposes are concerned, the Federal government are in a splendid position in the Soulanges section. They can build a canal overland for navigation alone quite cheaply no matter what way the river is improved, for power. If the river is improved for power this will not increase the cost to the Federal government as long as federal interests make the power people build the works in a reasonable way. If somebody came along and built a canal along the lines suggested by the Beauharnois people and later we came along and wanted to build a deep waterway, we could build it by using part of their works, for about twenty million. I mean we would pay that if we bore

the cost of locks, bridges, and other purely navigation works only. It would be much cheaper to go down through this canal than to go down the river or go independently across the country, because the banks would be there, and we would only have to build the bridges and locks.

Hon. Mr. MURPHY: Apart from what you have to pay?

Mr. McLACHLAN: Yes, just compensation.

Hon. Mr. MURPHY: Now, below that are there any conditions similar to those that have been described in Lake St. Louis?

Mr. McLACHLAN: Yes. Below that we have the Lachine Rapids Section between Lake St. Louis and Montreal. The Lachine canal ten miles long overcomes the drop in this section which is 46 feet. The improvement of the Lachine Rapids Section for power is very difficult and costly.

Hon. Mr. DANDURAND: What do you do with the old Lachine canal?

Mr. McLACHLAN: We leave it alone. We leave it so it can be used. We do not contemplate putting it out of commission in any way.

Hon. Mr. LYNCH-STANTON: You do not utilize it in any way?

Mr. McLACHLAN: No, we do not utilize it in any way. The Wooten Bowden proposition was to build a canal through this section much as we propose, but it was placed more inland than what we recommend. The idea at that time was to make a submarine channel for a number of miles from the outlet of Lake St. Louis to Lachine, then follow the Lachine canal for some distance and then strike overland through Ville Emard and through the westerly part of Verdun and swing back into the river and pass through walls that would be built up to contain the river or hold it at a higher level right through the reach of river down to Victoria bridge and Montreal, placing locks one below Victoria bridge and another in the westerly outskirts of Verdun, and a guard lock at Lachine. This required very extensive drainage work and carried the flow of the St. Pierre river underneath the canal in Verdun.

Hon. Mr. MURPHY: Where would that pass the water-works aqueduct?

Mr. McLACHLAN: The aqueduct is five miles up the river and some distance below the C.P.R. bridge. The idea was to syphon the city supply right underneath the canal. Now, in the interval between 1920 and 1924-25 when we again started to work, the town of Verdun grew very fast and grew to the west, and we came to the conclusion that the best thing to meet the situation would be to develop a route closer to the river as shown on the diagram. The route comes out of Lake St. Louis much the same way as was recommended formerly. From Lachine down to about a half a mile below the C.P.R. bridge the scheme is unwater part of the river and then excavate the canal inside it and then after retain the water at a higher level by the wall used to unwater. From below Highlands the canal strikes overland. It crosses the Montreal aqueduct near its mouth. At that point we provide syphon culverts large enough to carry 5,000 second feet under the canal and large enough to enable Montreal to develop whatever power their canal can develop for them if they complete the enlargement they started on ten years ago.

In our proposal we divided the drop in the canal differently from former proposals. We introduced three locks instead of two. By putting a lock at the upper end of Nuns Island we were able to lower the artificial level north of Nuns Island enough to take the drainage that comes out at that point into the basin without passing it under the canal. The first lock is below Victoria bridge, the second lock is at Nuns Island, the third lock is opposite the Verdun asylum and near the river. That kind of canal passes so close to the river that there will never be any bother with bridges and there is no populated part of the city of Montreal on the river side of the canal. We provide for one tunnel

underneath the canal just above the Verdun asylum. We did that because we thought some day there will be a bridge over the river in that territory.

Now, again, above the lock at the Verdun asylum we place a guard structure. Another thing which we did is this: We found that it would be to the advantage of power interests to have Lake St. Louis raised about five feet higher than it is in nature, especially in low water, so we provided for a dam across the crest of the rapids of the type used in the St. Andrew's rapids near Lake Winnipeg—a dam which can be closed in summer and opened in winter. We propose at the opening of every navigation season to hold the lake up nearly to its high water level and hold that level all summer by a dam, and at the advent of winter we would open up the wicket gates to allow the river to return to its natural condition. In that way we do not increase the cost of the works for navigation at all and yet we make it easier for power to be developed at a later date.

I will now show you what we propose as to future development of this section for power. It is not part of the project that we recommended to build for navigation but it is the best project found for power.

Hon. Mr. MURPHY: Is the power at present developed and used on the Lachine canal all within the limits of the city of Montreal?

Mr. McLACHLAN: All below Cote St. Paul. I do not know whether Cote St. Paul is within the limits of Montreal or not.

Now, the development of the Lachine section for power is a very difficult hydraulic problem, and the reason it is difficult is because there is a long stretch of river that is flowing so fast that it stays open and it is all in rock and it costs a fortune to enlarge to the point where an ice cover is secured. The only way we knew of by which we could put the development for power on the Lachine rapids on a marketable basis was to adopt a kind of peculiar scheme for splitting the river into two parts. It is a known hydraulic fact that if you dig a canal through rock and make it deep and line it with concrete on the side it will be very smooth. You can get that water to travel at seven or eight feet a second without much loss in head; and if you are going to have open water at all in that improved stream the best thing is to make it travel fast, because in that way you haven't a large area exposed and ice formation will be small. That was found out in the Soo. The American people have a canal two and a half miles long where the water travels about seven feet a second and it goes so fast that not much ice forms and any ice that does form is carried away and never sticks to anything. So, what we did here was: we figured on building a canal from Caughnawaga to La Tortue large enough to carry about 120,000 second feet.

Hon. Mr. MURPHY: That is on the south shore of the river?

Mr. McLACHLAN: Yes, that is on the south shore of the river. At about seven feet a second we found the loss in slope was only two to three feet, and we found we could build a power house at the foot that would develop 400,000 horsepower. That could be done with some slight change which could be made as required to the dam we built first. The diversion of this quantity of water would lower the lake if it was done without operating this dam, and with some slight changes to the dam that amount of power can be developed as a first stage in the improvement of this section.

Then, the second stage can be completed in this way: The part of the dam previously built can be replaced by a power house and dam farther down the river along with a longitudinal wall running from the foot of Heron Island up to that structure. If that is done, the sectional area of the river will then be large enough to carry a flow in winter of 140,000 second feet at a velocity so low that it will freeze over with an ice cover, and in that way we will have the sec-

tion improved for power, and the only open water we will have will be the narrow artificial channel from above Caughnawaga to La Tortue wharf. I might say that at the upper end of this artificial canal we have a control work so that if anything ever happened in the way of a big stone getting into the canal and fouling the bottom, we could reduce the flow and take it out. It was found that a portion of the Soo canal got fouled with rocks falling down, and after many years they had to clean it up. I doubt if this channel will ever have to be cleaned out if it is built properly.

Now, the cost of the power developed in this section is greater than in the Soulanges section and greater than in the International section, so there is no possibility of the power being used as far as I can see for perhaps twenty years, or some such period as that. So we do not need to concern ourselves more with it than we have done.

Hon. Mr. LYNCH-STAUNTON: What do you figure it costs?

Mr. McLACHLAN: It is in the report.

Hon. Mr. BEIQUE: I understand that in your report, you suggested the north side of the river?

Mr. McLACHLAN: Oh, yes, we suggested switching them about, do you mean?

Hon. Mr. BEIQUE: You mention in your report an alternative plan—the last one when you mention the canal on the south side; but your recommendation is that of the north side on the Island of Montreal.

Hon. Mr. MURPHY: Senator Beique means that as between these two proposals your report actually recommends the plan on the north side.

Mr. McLACHLAN: That is the side of the Soulanges canal. We recommend placing the canal on the north side of the river for navigation, but we did not make any other recommendation for power that I know of in this section.

Hon. Mr. MURPHY: Your recommendation is for the north side?

Mr. McLACHLAN: For navigation, absolutely. What we recommended for navigation is that this canal be built for navigation with a summer dam, across the river, and that is all we recommended to be executed in connection with the power. But we do know that afterwards power interests can develop the river in the way we suggest, and that this development will fit in with our works.

Hon. Mr. BEAUBIEN: You do not disturb the Lachine canal?

Mr. McLACHLAN: We do not disturb the Lachine canal or the Montreal aqueduct. We do not disturb the drainage of the country to any great extent. What we do with the development of power from the Montreal aqueduct is this: We give them a level which is lower in winter than is there in nature and one higher in summer than is there in nature in summer. The reason we are able to give them a lower level in winter than in nature is this: In the winter time Laprairie basin fills with ice and there is a six foot slope from the mouth of the St. Pierre river to Montreal. We build a lock and dyke from Victoria bridge up to Nuns Island and across to the lock to shore enclosing a space that can be connected up with the Harbour of Montreal.

Hon. Mr. MURPHY: Is that embankment the present one that runs down from the bridge?

Mr. McLACHLAN: The present embankment that protects Montreal and Verdun in the spring of the year runs along the shore from the north end of Victoria bridge to the St. Pierre river. Then up the tail race to a power house and back along the tail race and up the shore past the city of Verdun and up close to the asylum. That protects the city of Montreal from inundation in the spring of the year. The great accumulation of ice that forms in the Lachine

rapids—is stowed in the Laprairie Basin, and with the advent of spring it loosens from the shore and moves down in a mass into the narrow river below and forms a long gorge, and that raises water levels eight or ten feet above what they were in the dead of winter, and perhaps twenty feet above what they were in summer. That would flood Montreal and Verdun nearly every year if it were not for the works of protection that were built years ago. The jams are interesting. They are shown in the profile of the Lachine canal. The deep blue is the present summer water level and the pink is the winter jam. It may often be ten feet above that for a few days in the spring.

Hon. Mr. MURPHY: Does the report deal with the river below Montreal?

Mr. McLACHLAN: Now, below Montreal we were asked to determine certain hydraulic facts. The river itself as you know is deep enough to provide for more than twenty-five feet, and, consequently, there is nothing required to enable the navigation that we have in view to go through; but we were asked to determine what the effect of the Chicago diversion was on that long stretch of river between Montreal and the sea, and how it could be compensated for. We figured out what the drop was by the compilation of a lot of information that was never previously available and then figured if it could be compensated for by dredging a certain depth, and then when we came to Montreal Harbour we figured that there was no way by which you could deepen the harbour without undermining the walls of the piers, but we assumed that some day these piers would have to be rebuilt and it was reasonable to assume that when this was done compensation would be made for the loss of levels from the Chicago diversion, and we figured what proportion of that cost should be borne by it. It is very well covered in our report. We also figured on compensation by some other methods. We figured on compensating the natural level by the introduction of weirs in the deeper parts of the river similar to what we proposed doing in the St. Clair river. The cost, when we got it all worked out, was practically the same as the first estimate that we made, and I do not remember—whether we put it in the report or not.

Hon. Mr. MURPHY: Have you made any recommendation with regard to the river below Montreal?

Mr. McLACHLAN: We were not asked to make any recommendation other than to determine what it would cost to compensate for loss of level from the Chicago diversion. The cost of compensating for the Chicago diversion there is \$4,600,000.

Now, there are some other physical facts it might be well to mention at this time. In connection with navigation, the water temperature of the river in the fall of the year affects quite materially the season of navigation in various parts of the river. It is not generally appreciated, but you get ice in the fall of the year at the foot of Lake St. Peter fully a month before you get ice at the outlet of Lake Ontario. The reason for that is that Lake Ontario stays warm up until about the first of the year every year while the water down at Lake St. Peter starts to form ice about the first of December or perhaps earlier. Now, another fact that is interesting is that water at the outlet of the Lake of the Two Mountains which is water from the Ottawa river comes down to the freezing point a week or so before the water gets down to freezing at the foot of Lake St. Peter, so that navigation at the entrance of the Lachine canal closes earlier than any other part of the system due to the fact that some water from the Ottawa enters at that outlet and flows into the Lachine canal. The ice conditions as a consequence are a little more difficult to deal with as you go down the river because the season is longer and the ice forming period is longer. The winter season at the outlet of Lake Ontario and the International section is really quite short.

I don't know whether you want me to go any further with that part of the subject. I have, I think, described the works that were recommended in our report now. I do not know whether you want to discuss at another time the economics.

Hon. Mr. REID: As I understand the recommendations of your two section system which goes on the American side, it includes the building of one lock on the Canadian side fourteen feet deep?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: I would like to get this information the next time we meet. Supposing we were to carry out this scheme, put it as we have it at Sault Ste. Marie—that is, carry it out as you have it—then the one new lock that you are putting in, instead of making it fourteen feet make it twenty-five feet, and then make another lock. In case anything happens to one lock you have the other. Would you let us know at the next meeting what the cost would be.

Now, the next question is this. I want it thoroughly understood. How many years would it take, say, to do the International section?

Mr. McLACHLAN: We have figured the whole International section at about eight years. To do the work down to and including Crysler Island would take five.

Hon. Mr. REID: That is five, say, from Prescott to Crysler Island and three years increase to Cornwall. If the Cornwall section were done that means from Prescott to Coteau Landing?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: That means that sixty-five or seventy miles would be completed through for twenty-five foot navigation?

Mr. McLACHLAN: That is right, sir.

Hon. Mr. REID: Now, that is for the 38 million dollars—35 million dollars plus 3 million extra. If you had seven and a half million dollars every year for five years that would do it, and if it took six years it would not take quite as much as that per year. Could you give us that Canadian section through, say, to Coteau with the development of 460,000 horse-power at Crysler Island and 200,000 at Coteau?

Mr. McLACHLAN: I think a bit of confusion has arisen in your mind, Senator Reid. The thirty-four or thirty-seven million you are speaking of is just for the navigation work alone. That does not include common work—power and navigation. If you want to carry navigation down to Coteau, put the canals for navigation on the Canadian side and develop Crysler Island alone that would cost you about 180 million dollars.

Hon. Mr. REID: Now, that is the one point I did not understand. What do you mean by power, and then the superstructure?

Mr. McLACHLAN: The superstructure is the building.

Hon. Mr. REID: And the machinery?

Mr. McLACHLAN: The machinery and the superstructure are things you can always put in after you raise your levels.

Hon. Mr. REID: What I was asking is this: If the government, say, built the locks at Crysler Island for themselves—

Mr. McLACHLAN: It would save of the 180 million—it would save about 40 million, something like that.

Hon. Mr. REID: So, I understand, according to your estimate, you would have for navigation alone, say, all the way through, \$8,732,000 at Crysler Island, and then the other one is \$25,680,000?

Mr. McLACHLAN: That only includes the side canals.

Hon. Mr. REID: Here is what I was going to say. At Crysler Island you have \$8,732,000 for navigation alone?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Then you have \$69,986,000 for works common to navigation?

Mr. McLACHLAN: That is for these red works. This is excavation in the river for enlarging it so as to get an ice cover all the way down to the plant including the dam between the power house.

Hon. Mr. REID: This is what you call common works?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Common to navigation and power?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: That would be \$78,720,000?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: Then that gives 660,000 horsepower?

Mr. McLACHLAN: That is the 600,000 horsepower.

Hon. Mr. REID: So you have answered one question and there is another. For eight years with nine and a half million you could give us that route through to Coteau if you had that much each year?

Mr. McLACHLAN: Yes.

Hon. Mr. REID: And the other point is: Supposing this is all carried out with your two-stage scheme with the whole thing on the American side, as is shown, then I ask if you would find out or make an estimate of what it would cost—you are going to put in one lock fourteen feet deep—to make that twenty-five in the other lock so that we could have either side to use? What I am trying to say is that that would then give us control of the channel so far as our own boats are concerned if they wanted to go up through Canadian locks. Do you understand?

Mr. McLACHLAN: I think I do.

The CHAIRMAN: I think I am voicing the sentiment of the committee when I say that we are under a great obligation to Mr. McLachlan for the exhaustive information he has given us to-day.

The Committee then adjourned to meet at the call of the chairman.

MINUTES OF EVIDENCE

WEDNESDAY, 9th May, 1928.

The special Committee on the Development and Improvement of the St. Lawrence River, met this day at 11.30 o'clock a.m.

The Honourable C. E. Tanner presiding.

Dr. O. D. Skelton, Under-Secretary of State for External Affairs, addressed the committee on the matter of Treaties and Agreements which might have a bearing on the International Aspect of the St. Lawrence Waterway Project.

Dr. SKELTON: Mr. Chairman and Gentlemen, I understand that what you wish this morning is that I should run over the Treaties and Agreements which may be said to have a bearing on the International aspect of the St. Lawrence Waterway Project. I shall try, therefore, to give a brief statement of the facts, so far as I am aware of them as to the International status of the River St. Lawrence, and as to what the present rights of Canada and the United States are as to navigation on that river.

Hon. Mr. REID: Your discussion will be on the International Section from Cornwall west?

Dr. SKELTON: No, Senator Reid, on the whole river. There are special phases involved in dealing with the International section. The first question is as to whether there is any general rule of International Law, aside from specific treaties and agreements, which would give the United States or any other country special rights or privileges in the St. Lawrence river. I may perhaps say a word on that first. I think the consensus of opinion is to the contrary. It is quite true that for the past hundred years there has been steadily growing a sentiment in favor of opening to navigation by all countries any rivers that may be considered international; that is, navigable rivers separating two countries or traversing two countries. Until the early days of the Nineteenth Century it was the custom of every country to endeavour to restrict access to rivers over which it had control to vessels carrying its own flag, or, if it was a river running between two countries, to vessels carrying the flags of the two riparian states. As a result of a series of discussions, usually following the great wars which led to widespread readjustments of the whole international situation—that is, in 1815 following the Napoleonic wars, 1856 after the Crimean war, and 1919 after the great European war—as a result of a great number of congresses and conferences, there has come to be a network of treaties providing for the opening either to all the riparian states or to all states without distinction of practically all the great rivers of Europe, the Danube, the Rhine, the Vistula, the Dvina and the Elbe are now by treaty open either to all countries which own any part of the territory on the lower or upper regions of the rivers, or, in most cases, to the vessels of any other country without distinction.

Then, the same regime has been extended to the great rivers of Africa—particularly the Congo and the Niger. The Congress of Berlin in 1887-88 arranged for the opening of both these rivers to vessels of all flags without distinction.

The same thing is true of South America. The river Amazon has been free to all vessels since 1867; and the river de la Plate—the Uruguay and Parana—the other two great rivers of South America are similarly open to all vessels.

Some authorities have, therefore, drawn the conclusion from a survey of these many treaties or agreements that it may be said to be an accepted rule of International Law that all great international rivers are open to navigation either by the riparian states or by all states. The consensus of opinion of International Jurists is distinctly against that interpretation. In other words, the prevailing view is that such rights of navigation in rivers in Europe, Asia, Africa and South America as exist are based not on any generally recognized principle of International Law, but on special treaties and agreements; that they are conventional, not matters of right.

Certainly that is true as regards North America, and, particularly, the St. Lawrence. Canada has never recognized the existence of any general rule of International Law which would govern the navigation of the St. Lawrence. We have held always that it was a matter for specific arrangement with the United States or with any other power that might be interested. While the trend of development in other continents may have a certain bearing on the question, it does not definitely apply.

HON. LYNCH-STAUNTON: Was there ever any objection raised in time of peace to any ship or any flag going into any particular river of the world?

Dr. SKELTON: Do you mean seaports, or inland river ports?

HON. MR. LYNCH-STAUNTON: Yes, inland ports?

Dr. SKELTON: Certainly. There are inland river ports that have been barred to alien flags. The seaports are not barred, but it has only been by special treaty and agreement that river ports have been opened to foreign flags, and sometimes, even in those cases, the coasting trade is still reserved.

HON. MR. LYNCH-STAUNTON: Oh, yes; I know that.

HON. MR. ROBERTSON: Are all the rivers you have mentioned actually open to deep water navigation, or have any of them canals?

Dr. SKELTON: Some of them have canal systems, but in several cases it is specifically provided that the canals are also open.

HON. MR. ROBERTSON: That is a matter of treaty?

Dr. SKELTON: Yes, that is a matter of treaty. It is not found in all the agreements.

HON. MR. LYNCH-STAUNTON: There is no International Law regarding them, it is the treaty. The general Common Law—the International Law does not apply; they are all treaty?—

Dr. SKELTON: Quite so. We can say that a general rule of International Law is in process of formation, but it has not yet been completed.

Coming then to the treaties dealing with the St. Lawrence, we begin, of course, with the treaty of 1783, ending the war of American independence. It was there provided, you will recall, that the boundary between the United States and Canada was to run along the Forty-fifth parallel until it struck the St. Lawrence and was to follow the middle of the River St. Lawrence up to Lake Ontario. It was not long until disputes arose as to what was the middle of the River St. Lawrence, and in the treaty of 1814 provision was made for appointing special commissioners to determine the question and to locate definitely the boundary from the Forty-fifth parallel up to Lake Ontario. These commissioners met and presented their report which was accepted in 1822. They had no very definite instructions to guide them in determining what was the middle of the river, but they agreed at the outset that his did not mean the middle of the deep water channel; they agreed next that they would try to avoid cutting across the middle of islands; that they would try to follow one channel or the

other and assign every island completely either to one country or the other. That was the general principle they followed, and they laid down the line with which we are familiar today.

You have noticed in looking at the maps which Mr. McLachlan was showing you the other day that in the Long Sault region the United States has far the greater number or area of islands, and it would, perhaps, from some points of view, have been more convenient if the channels had run on lines so as to give Canada a bigger share of those islands to-day. Following the war of 1812 the British commissioners were very anxious that what they then called Grand island and what we now call Wolfe island, immediately opposite the harbour of Kingston and which had at first been assigned to the United States, should be transferred to Canada. Kingston, of course, was the chief naval base on the lakes, a possible Capital and in fact eventually a capital, and it was felt undesirable to have a foreign country owning an island a mile or two out in the bay. So they were very anxious to trade certain other islands with the United States in order to get back Grand island or Wolfe island. That is the reason why the United States was given a greater number of islands at the Long Sault.

There was no great difficulty about that delimitation in 1822. But about 1824 a lengthy controversy began as to whether the United States, as owning part of the territory on the great lakes, had the right of navigation down the River St. Lawrence to the sea. From about 1824 to 1829 or 1830 a very elaborate and prolonged exchange of correspondence took place between the United States government and the British government on that question. Henry Clay and Mr. Adams, the United States Secretaries of State, took strongly the ground that any state owning territory on the upper reaches of the river had a natural God-given right to navigate down to the sea; to carry its goods to the world's markets through the lower reaches of that river. The British government strongly denied that and held that though a beginning had been made in applying similar principles in Europe, that had been by special agreement and did not bear out the claim that there was a universal law of nature which could be applied to the navigation of all great rivers. So, the demands of the United States were not accepted, and a little later the building of the Erie canal and later still the building of the railways changed the situation. States like Ohio and Michigan which were anxious to get an outlet for their goods to the sea, found another means, and the tension of the situation ceased for the time.

Now, the next treaty point to which I need refer is the Ashburton-Webster Treaty of 1842, which has one brief article referring to the River St. Lawrence. The Ashburton-Webster Treaty was, of course, mainly concerned with settling the Maine boundary, but once that question had been settled one or two minor points were taken up. Article 7 of the Ashburton-Webster Treaty reads as follows:—

It is further agreed, that the channels in the River St. Lawrence on both sides of the Long Sault Islands and of Barnhart Island, the channels in the River Detroit, on both sides of the Island Bois Blanc, and between that island and both the Canadian and American shores, and all the several channels and passages between the various islands lying near the junction of the River St. Clair with the lake of that name, shall be equally free and open to the ships, vessels and boats of both parties.

That clause was put in at the suggestion of Lord Ashburton, who pointed out that in the Long Sault and in the River St. Clair the navigable channels were on the United States side, and while there was no likelihood that the use of them by Canadian vessels would be barred, it was desirable to have an explicit understanding that they should be open. Mr. Webster agreed on condition that a similar provision were put in as to the River Detroit, at Bois Blanc Island, where

the chief channel was on the Canadian side, and, therefore, this clause was drawn up and agreed upon.

Then the next development is in 1854.

Hon. Mr. REID: Before you read that might I ask if that is the treaty in which there is another clause asking the British government to intercede with Canada to try to get them to allow the United States the use of waters between Cornwall and St. Regis?

Dr. SKELTON: That comes later. The treaty of 1854, the Reciprocity Treaty, as you recollect, provided for a broad exchange of natural products between Canada and the United States and for access to the fisheries of both countries, and also included a clause regarding the free navigation of the St. Lawrence river and canals and of Lake Michigan. That treaty lapsed in 1866 as a result of the notice given at the expiry of the due time by the United States, and the rights of navigation that had been accorded lapsed simultaneously.

Hon. Mr. LYNCH-STAUNTON: The whole treaty lapsed?

Dr. SKELTON: The whole treaty lapsed, including these clauses as well as the fisheries and tariff clauses.

Then, in 1871 came the Treaty of Washington. That treaty, you will recall, was made between His Majesty and the United States primarily for the purpose of dealing with the Alabama claims brought by the United States against Great Britain. Advantage was taken of the meeting to deal with certain Canadian questions, and along with Lord de Grey, Sir Edward Thornton, Sir Stafford Northcote and Professor Bernard, Sir John A. Macdonald was appointed as the fifth of the British Plenipotentiaries. The Treaty of Washington contains several clauses dealing with navigation rights. Article 26 reads as follows:—

XXVI. The navigation of the River St. Lawrence, ascending and descending from the 45th parallel of north latitude, where it ceases to form the boundary between the two countries, from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the citizens of the United States, subject to any laws and regulations of Great Britain or of the Dominion of Canada, not inconsistent with such privilege of free navigation.

That is from Cornwall to St. Regis. The second paragraph of the same article provides:—

The navigation of the Rivers Yukon, Porcupine, and Stikine, ascending and descending from, to, and into the sea, shall forever remain free and open for the purposes of commerce to the subjects of Her Britannic Majesty and to the citizens of the United States, subject to any laws and regulations of either country within its own territory, not inconsistent with such privilege of free navigation.

That is one of the most important of the provisions: That the navigation of the River St. Lawrence, ascending and descending from Cornwall to the sea shall forever be open to citizens of the United States.

Hon. Mr. BEIQUE: The upper part was settled by a previous treaty?

Dr. SKELTON: The upper part was international, and the United States had a channel—equal rights, it was assumed.

Hon. Mr. BEIQUE: But were they permanently equal rights?

Dr. SKELTON: In the upper part—the International section?

Hon. Mr. BEIQUE: Yes?

Dr. SKELTON: That had never been definitely and specifically mentioned. In 1822 when the commissioners were drawing up the boundary line of the International section of the river there was a suggestion that a clause should be put in providing that both countries should have full rights of navigation on both

sides of the International section. The British minister at Washington objected to this clause on the ground that it might be assumed that this right existed, and it was not desirable to call it into question by assuming it was necessary to put in a specific provision in the treaty. So, down to the Boundary Waters Treaty of 1909 there has never been any specific provision that each country should have free use of both sides of International waters. It was understood though, and there was no real objection made on that score.

Hon. Mr. LYNCH-STAUTON: Has that word "free" ever been used—has it ever been contended by the Americans or by the Canadians that the word "free" there embraces the right to travel through any artificial channels made on the mainland of either side?

Dr. SKELTON: That is a very interesting point, Senator. Perhaps if I read the next Article that will enable me to attempt a reply to your question.

Hon. Mr. REID: Just before you leave that. You are discussing that clause in the treaty of 1871 where you say that Canada agreed to give the United States free navigation. It was the treaty before that they made with Great Britain in which there is a clause, if I remember rightly—I have read it a good many times—in which the United States asked the British Government to intercede with Canada to get the right that we gave them.

Dr. SKELTON: Yes, there was a somewhat similar reference in the treaty of 1854.

Hon. Mr. REID: The reason I want that put on the record is this: that was an admission by the United States that they had no right east.

Dr. SKELTON: The same point comes up, and I am just going to discuss it by the next Article. Article 27 of the Treaty of Washington is as follows:—

The Government of Her Britannic Majesty engages to urge upon the Government of the Dominion of Canada to secure to the citizens of the United States the use of the Welland, St. Lawrence, and other canals in the Dominion on terms of equality with the inhabitants of the Dominion; and the Government of the United States engages that the subjects of Her Britannic Majesty shall enjoy the use of the St. Clair Flats Canal on terms of equality with the inhabitants of the United States, and further engages to urge upon the State Governments to secure to the subjects of Her Britannic Majesty the use of the several State canals connected with the navigation of the lakes or rivers traversed by or contiguous to the boundary line between the possessions of the High Contracting Parties on terms of equality with the inhabitants of the United States.

I will just read the next Article before replying to Senator Lynch-Staunton's question:—

The navigation of Lake Michigan shall also, for the term of years mentioned in Article XXXIII of this treaty be free and open for the purposes of commerce to the subjects of Her Britannic Majesty, subject to any laws and regulations of the United States, or of the States bordering thereon, not inconsistent with such privilege of free navigation.

That provision lapsed, and we had no technical right to navigate Lake Michigan down until 1909. Now, it may be noted that one of these Articles deals with the navigation of the River St. Lawrence without any specific reference to the question of whether it included canals, and that the next Article refers to the canals, the Welland, St. Lawrence and other canals in the Dominion and certain in the United States. Senator Lynch-Staunton asks whether the interpretation has been ever held that the first Article giving navigation on the River St. Lawrence ascending and descending down to the sea, did not confer the

right to use the canals on the Canadian side of the International Section. So far as I am aware that question has never come up in any international discussion. There has been no pronouncement of either government upon the question, and there has been no discussion of it by the courts. But the question has been occasionally discussed by private inquirers. But to answer your question, Senator Lynch-Staunton, I might perhaps refer to the way in which Article 27 came to be inserted in the treaty. When the treaty was first drafted, Article 27 was not included. The British commissioners, aside from Sir John Macdonald, who had been familiar with the gradual trend of opinion in Europe which opened all great rivers to free navigation by all countries, agreed to the drafting of the clause as I have stated it: Navigation of the St. Lawrence, ascending and descending, shall be open. Sir John Macdonald objected to this, but finally concurred. Then wishing to use as much as he could the River St. Lawrence as a bargaining power—being prepared, as he stated, to exchange free trade for free transit—he suggested that as this clause would seem to imply the inclusion of canals, because it might be held that as it gave the right to the vessels of the United States to ascend as well as descend, and as they could not ascend that International Section without using the canals, therefore, if this was to be interpreted to have any meaning, it meant the use of canals as well as the river. When, therefore, he could not induce his fellow British commissioners to change their view on the wording of that clause, he suggested that another clause should be inserted which would include a specific reference to the canals, and might be taken to imply that the previous clause referred to the river and its natural channels only, and did not include the canals. And so it was at Sir John Macdonald's suggestion that clause 27, providing for reciprocal agreements to endeavour to induce the Canadian Governments and the State Governments respectively to open, was inserted.

Hon. Mr. BEIQUE: Where is the discussion to be found?

Dr. SKELTON: The best brief discussion is in Sir Joseph Pope's reprint of Sir John Macdonald's correspondence.

Hon. Mr. LYNCH-STAUTON: In the Letters?

Dr. SKELTON: No, the Life. He includes in his Memoir several letters exchanged by Sir John Macdonald. There is one letter, I think to Dr. Tupper, in which Sir John gave the reasons for getting this second clause put in.

Hon. Mr. McLENNAN: Did Canada get the rights in the canals referred to?

Dr. SKELTON: Perhaps I might read the clause again: "The Government of Her Britannic Majesty engages to urge upon the Government of the Dominion of Canada" That phrase was put in to make it parallel to the phrase which occurs a moment later in which the Government of the United States was to urge upon the State governments equal use of the State boundary canals. Canada did not definitely promise; the British Government merely said it would try to persuade the Canadian Government to do it. Then the Government of the United States promised that Canada without any question will have the use of the St. Clair Flats canal, and engaged to urge upon the State governments the equal use by Canadians of the State canals.

The question has been raised whether these clauses were carried out. In the first place, the Government of Her Britannic Majesty never, so far as I am aware, took up the question with the Canadian Government, because, as a matter of fact, even after the treaty of 1854 had ended in 1866 Canada had not interposed any objection to the continued use of the canals by the United States, and it was not necessary for the British Government to make representations.

Now, as regards the other side of the question, the United States gave the free use of the Federal canals which it owned without any question, but some question did occur in connection with the State canals. There was a great deal of controversy back in the seventies, in the years immediately following the treaty. As I recollect it, the controversy arose particularly over the Whitehall or Lake Champlain canal and over the Erie canal. The state of New York on the question being raised whether Canadian vessels could go through, replied that there were no laws or regulations of the state forbidding Canadian vessels to use their canals, but it turned out that there was a United States Federal regulation which made this concession a rather barren one. There was a rule of the United States Customs providing that every vessel entering United States waters with a cargo from abroad should enter at the nearest port of entry and unload its cargo there. It was held that while a Canadian vessel could use the canals themselves it could not carry goods in bond down the Hudson river to New York, as the Hudson river was claimed not to be a river contiguous to the border line. There was a great deal of friction, and it was claimed on the part of Canada that the ruling in question was a very narrow legalistic interpretation. It was not a very important matter because, as a matter of fact, there was little Canadian traffic wanting to use that route, but the point of principle was raised.

Hon. Mr. McLENNAN: There was barge traffic.

Dr. SKELTON: Yes, there was a certain amount of barge traffic in lumber.

Hon. Mr. McLENNAN: Has that restriction ever been removed?

Dr. SKELTON: I haven't followed that up, Senator, but I haven't heard any complaint about it. I am not sure whether that applies or not.

Hon. Mr. McLENNAN: It is worth looking up.

Hon. Mr. REID: If you look it up, see if you can find out whether the American Government put those customs restrictions on because, if I understand it rightly, long after that the barges ran right through from Ottawa to New York with lumber; that is, after that treaty, so that it must have been some years afterwards when that restriction was put on, and then, of course, traffic between Ottawa and New York in Canadian vessels ended; but up to the present time American vessels can come right through to Ottawa with their cargo.

Dr. SKELTON: Yes, that is correct. As far as I recollect, the regulation of the United States was one of long standing, but the question of its application did not come up until the seventies.

Hon. Mr. BEIQUE: I am under the impression that there was a discussion and some arrangement in connection with the Whitehall and the Chambly canals, between the two canals.

Hon. Mr. DANDURAND: There is a movement of Canadian lumber through the Chambly canal up to Whitehall and down to New York.

Dr. SKELTON: If so, the regulation must have been changed. As a matter of fact, just as the building of the Erie canal and of the railways made that less important to the United States to have that navigation of the St. Lawrence so the development of our own railways made the question of whether we could use United States canals not very important, except in principle. On the other hand, there were complaints by the United States as to the way in which we carried out the provisions about the canals. Far from trying to bar the United States from using our rivers and canals, we became very anxious that they would use them in order to bring traffic to Montreal and to the River St. Lawrence. In the eighties and the early nineties the Canadian government introduced certain regulations tending to compel United States vessels to use the River St. Lawrence and the canals down to Montreal. One of these regulations took the form of putting tolls on the Welland canal and rebating those tolls

to vessels which went clear down to Montreal, but not rebating them in case the vessel went only as far as Oswego, let us say. The United States protested that it was a violation of the treaty. The Canadian government took the ground that it was quite within the letter of the law, that the treaty forbade discrimination against United States vessels, and that there was no discrimination; but it did not forbid discrimination against United States routes or ports, and that they were within their rights in trying in this way to direct navigation to Montreal rather than to Oswego. A little later, as a result of the application by the United States of discriminating tolls on the Soo canal, an agreement was come to by which the discrimination was dropped, and, eventually, of course, all tolls were ended.

Hon. Mr. REID: I don't think Dr. Skelton made that as plain as it should be made. These tolls were put on American vessels if they carried grain from a Canadian port to another Canadian port. For instance, an American vessel would load at Port Arthur with Canadian grain and take it to Ogdensburg—that is the point, not Oswego—and there tranship it into another American vessel and take it to Montreal, thus carrying Canadian grain by an American vessel from one Canadian port to another, and this was put on for the purpose of protecting our coastal trade.

Dr. SKELTON: There was a regulation providing that transshipment might be permitted at a Canadian but not at a United States port, but the regulation to which I referred was one which applied equally to Canadian and United States vessels, and which put a premium on going through to Montreal and made it difficult for vessels to stop at Oswego, Ogdensburg, or any other United States port.

Hon. Mr. REID: What I mean is this: These American vessels on which that toll was placed—that toll was placed on them if they carried Canadian grain from one Canadian port to another and that toll was charged and a large amount collected. The American government took it up with the Canadian government and we had to refund the tolls that we had collected on the American vessels.

Dr. SKELTON: That is a question of the interpretation of the coasting law; the other is the interpretation of the treaty provision as to canals. Now, is there any further question on the treaty of 1871 before I go on to the next?

Hon. Mr. BEIQUE: Did the question ever arise as to whether the American government would have the right in the St. Lawrence to improve navigation, or whether the right of sovereignty of the Canadian government is absolute?

Dr. SKELTON: In what section of the St. Lawrence?

Hon. Dr. BEIQUE: In the National section.

Dr. SKELTON: No, I have never heard of any such suggestion or claim.

Hon. Mr. BEIQUE: Now, the United States did a great deal of work in the International section?

Dr. SKELTON: Yes, in the International section in the St. Clair and Detroit rivers, but by consent always of the Canadian government.

Hon. Mr. BEIQUE: Always by consent?

Dr. SKELTON: Yes.

Hon. Mr. REID: In the St. Lawrence?

Dr. SKELTON: No. The question has never come up as far as I know, in the St. Lawrence.

Hon. Mr. BEIQUE: You say in every case they asked the consent of the Canadian government?

Dr. SKELTON: Quite so.

Hon. Mr. BEIQUE: Was it an admission—an implied admission that the treaty had not effected the right of sovereignty of the Canadian government?

Dr. SKELTON: Oh, yes; I think there was never any question as to that, Senator.

Hon. Mr. BEIQUE: So that answers my question from St. Regis to the sea; they would have no right to make any work in the St. Lawrence.

Hon. Mr. McLENNAN: Could you tell us about the Soo canal? At Sault Ste. Marie there was some difficulty arose?

Dr. SKELTON: At the Soo canal?

Hon. Mr. McLENNAN: Were you going to take it up again?

Dr. SKELTON: No. The only incident I recall in connection with the Soo canal, aside from the fact that the United States applied tolls there in retaliation against the Canadian government action as to the rebate of tolls I have just mentioned—the only other incident in connection with the Soo canal I can recollect is the fact that there was some difficulty as to transporting Canadian troops and munitions through it at the time of the Riel Rebellion.

Hon. Mr. McLENNAN: Although navigation was free in these canals?

Dr. SKELTON: That question was raised. I may say that during the great war no such question was ever raised, and during the nearly three years before the United States came in there was no question raised as to vessels carrying Canadian troops or carrying Canadian munitions going through United States channels or waters or even going into United States harbours.

Hon. Mr. LYNCH-STAUTON: Is it now admitted or denied that either nation has the consent or right to navigate the whole length of the river with war material or troops?

Dr. SKELTON: The point has never been formally settled. But the United States never raised it during that period.

Hon. Mr. LYNCH-STAUTON: Didn't they object to our troops going through our canals?

Dr. SKELTON: That was away back in 1885.

Hon. Mr. LYNCH-STAUTON: On what did they base their objection?

Dr. SKELTON: I assume on the ground that it was a violation of the law of neutrality. It was their canal. I think it was a far-fetched ruling.

Hon. Mr. LYNCH-STAUTON: We were only going to our own territory.

Dr. SKELTON: Still we were going through their waters. They might have been quite right if we had been at war with another country instead of merely suppressing an insurrection on our own territory.

Hon. Mr. LYNCH-STAUTON: Is there any such rule that it is a violation of neutrality if we were at war with another country, to traverse waters that are free to us?

Dr. SKELTON: It quite frequently is forbidden, Senator. There is a special provision made in the case of the Suez canal and the Panama canal that they are open in war as in peace to vessels of war as well as of commerce.

Hon. Mr. REID: I have one question to ask following up what Senator Beique has said. I understood you to say that in the St. Clair river they asked the consent of Canada, and that there was an understanding between the two countries, but going down from Lake Ontario, east, the question has never been raised as to us having the right to build canals as much as we like as long as it is on our territory?

Dr. SKELTON: No, sir. Senator Beique's question was whether in the case of construction on our side—

Hon. Mr. BEIQUE: In the river itself.

Dr. SKELTON: Whether the United States had ever requested in the case of the lower St. Lawrence the right to take action, and I said that question had never arisen, though it had in the St. Clair and Detroit rivers.

Hon. Mr. WILLOUGHBY: Is there any right of countries to navigate the lower part of the St. Lawrence in the salt water as far as salt water comes up the river?

Dr. SKELTON: I do not think there is any general right, so far as the waters are territorial.

Hon. Mr. McLENNAN: Am I right in my remembrance of the river episode that the United States had been deepening their own channel through their own waters and then they came up to complete the navigation of it, and they came up by consent into Canadian territory and deepened the channel there?

Dr. SKELTON: Yes, in the Detroit and St. Clair rivers there have been a good many different instances. One question came before the International Joint Commission, to which I will refer to when I come down to the Boundary Waters Treaty.

Hon. Mr. BEIQUE: Doctor, I take it to be your opinion that the United States have no other rights in inland canals but what they have under treaties?

Dr. SKELTON: No, I should think not. There is no general right.

Hon. Mr. BEIQUE: That would apply also to the States on both sides?

Dr. SKELTON: Yes. Strictly concerned, there are no rights except by treaty.

Hon. Mr. BEIQUE: Except specifically given?

Dr. SKELTON: Yes, except specifically given.

Hon. Mr. BEIQUE: And it is confirmed by the fact that there were treaties at St. Clair and other parts to cover similar rights?

Dr. SKELTON: Yes. Of course, with regard to the point that Senator McLennan raised as to the interpretation of that clause regarding the St. Lawrence river navigation ascending and descending—whether that covers canals or not, I mentioned that Sir John Macdonald had inserted an article which by implication tended to show it did not, but it is undoubtedly still open to argument. Whatever the exact meaning of this term “ascending and descending” is, Sir John Macdonald tried to safeguard it; but whether he did or not is a question.

Hon. Mr. LYNCH-STAUTON: Does anybody contend that it is open to argument? Does any authority in the United States or Canada contend that it is open to argument?

Dr. SKELTON: No authority has done so, as far as I know. The question of interpretation has never been discussed by any governmental agency either in the United States or Canada; any discussion has been by private parties.

Hon. Mr. REID: Has that treaty ever been interpreted, say, in the Province of Quebec. Take a power company like the Cedars Rapids Company that does not interfere with navigation, will the United States have anything to say so far as the rights of that concern go?

Dr. SKELTON: As far as I am aware, that question has never been raised.

Hon. Mr. REID: Now, the Cedars Rapids Power Company which is down in the Province of Quebec got a charter from the Dominion and before they were allowed to proceed with the work the United States Boundary Waters Commission had to be applied to and their consent obtained?

Dr. SKELTON: They did not have to; but I will refer to that point when I come to it.

I believe the next treaty reference is to the Boundary Waters Treaty of 1909. The Boundary Waters Treaty of 1909 as you will recollect was the out-

come of a preliminary experiment in joint inquiry into international boundary problems which had been made some years earlier in the establishment of the International Waterways Commission. So far as I am aware the first suggestion of the establishment of a joint body to deal with waterway problems along the boundary came from a Canadian in a discussion at an Irrigation Conference; the matter was taken up first in the United States, which suggested that such a body should be set up to deal with waterways. The suggestion was accepted after some time by Canada, and the International Waterways Commission was established.

Hon. Mr. MURPHY: That is distinct from the International Joint Commission of to-day?

Dr. SKELTON: Quite so.

Hon. Mr. MURPHY: Sometimes they are confounded—very often.

Dr. SKELTON: Yes. Sir George Gibbons was chairman of the Canadian section with Dr. W. F. King and Mr. Louis Coste; Mr. Mabce preceded Sir George as chairman. This is the old body. The International Waterways Commission was a body of very limited powers. It could merely investigate and report. It had none of the semi-judicial or administrative duties which in certain respects have been entrusted to its successor. At the same time, the range of territory over which it exercised its powers was greater than that in which the International Joint Commission to-day operates. The International Waterways Commission was empowered to investigate and report on questions dealing with "waters adjacent to the boundary between Canada and the United States, including all the waters finding their way by the River St. Lawrence to the sea"; so, you will see that its scope was quite wide geographically though the powers were limited merely to investigation and report.

Now, with regard to Senator Reid's question. During the tenure of office of that body application was made, by the Cedars Rapids Manufacturing and Power Company to the Dominion Government for permission to build works in the St. Lawrence at Cedars and permission was granted subject to the consent of the Department of Public Works that it would meet their requirements as to navigation. The Department of Public Works requested the International Waterways Commission which had been dealing with various power problems to make a report on the question, and that Commission did make a very brief report. As far as I recall they said, "We have not gone into this very fully, and the Department of Public Works has all the information before it; but on general principles in the interests of navigation, we do not see any objection to you going on"; and with certain restrictions the Department of Public Works suggested the granting of a charter to the Cedars Rapids Company.

Hon. Mr. REID: They held three meetings and had a lot of evidence taken?

Dr. SKELTON: Yes. They held two or three meetings and they made a brief report.

Then, as a result of these preliminary inquiries, it came to be clear that there were possibilities of settling the countless problems that arise in boundary waters, both as to irrigation and navigation and as to power, by continuing the experiment on somewhat broader though somewhat different lines. One thing the old International Waterways Commission did was to lay down certain conditions of priority in the use of boundary waters, domestic and sanitary uses being first, navigation next, and power and irrigation third, and so on. Another thing they did was to recommend to both governments that they should set up a permanent body which would take the place of this temporary body and to use it for the settlement of all boundary waters questions. That was agreed to by both governments, a treaty was eventually ratified which provided not merely for the establishment of a permanent body—the International Joint Commission of to-day—but referred to it certain boundary water problems and

also made it possible to refer to this commission certain broader questions in dispute between the two countries that had no special reference to the boundary waters; in other words, making it, as Sir Allen Aylesworth said, a miniature Hague Tribunal.

I am now going on, therefore, to the treaty of 1909 which was ratified in the following year between His Majesty and the United States, commonly called the Boundary Waters Treaty. I will read first the preliminary Article in that treaty:—

For the purposes of this Treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the International boundary between The United States and the Dominion of Canada passes, including all bays, arms and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers and waterways, or waters flowing from such lakes, river, and waterways, or the waters of rivers flowing across the boundary.

Hon. Mr. LYNCH-STAUNTON: What is the meaning of the words "flowing across the boundary"?

Dr. SKELTON: A river such as the Kootenay or the Richelieu is not considered technically a boundary river. The International Joint Commission might have certain rights or duties in connection with it, but they are not technically included in the definition of boundary waters given in the preamble. Now, there may be boundary waters to which Article I specifically applies. Boundary waters roughly include part of the St. John river, the St. Croix river, the St. Lawrence river from Cornwall to Lake Ontario, Lake Ontario, the Niagara river, Lake Erie and so on up to Lake Superior.

Hon. Mr. REID: But would not include from Cornwall to the sea?

Dr. SKELTON: It would not, Senator.

Hon. Mr. LYNCH-STAUNTON: It is not boundary water?

Dr. SKELTON: It is not included in boundary waters. If that Cedar Rapids application to which you referred had come up it would not have been referred to the International Joint Commission.

Hon. Mr. REID: That is if it had come up since 1909; it was prior to that?

Dr. SKELTON: Yes. Now, that is the preliminary article.

Hon. Mr. BEIQUE: I would like you to tell us whether in the wording there there is anything that may cover canals?

Dr. SKELTON: Yes, just in the next Article, Senator.

The High Contracting Parties agree that the navigation of all navigable boundary waters shall forever contain free and open for the purposes of commerce to the inhabitants and to the ships, vessels, and boats of both countries equally, subject, however, to any laws and regulations of either country, within its own territory, not inconsistent with such privilege of free navigation, and applying equally and without discrimination to the inhabitants, ships, vessels, and boats of both countries.

Hon. Mr. LYNCH STAUNTON: Does that carry any further than the previous treaties had carried?

Dr. SKELTON: Yes. It specifically grants a right which was never specifically given before to both sides to use the water on the opposite side of any boundary river. It might have been alleged that Canada had no right to use or traverse the United States side of the boundary rivers.

Hon. Mr. LYNCH-STAUNTON: Surely the free navigation of a river included the river from bank to bank?

Dr. SKELTON: But the free navigation, you will recall, Senator, as provided in the treaty of 1871, applied only to the part from Cornwall down to the sea; now, this clause provides for the other half of the river—from Cornwall up to Kingston.

Hon. Mr. BEIQUE: And above?

Dr. SKELTON: And above, of course.

Hon. Mr. REID: Regarding the word "free." If we put tolls on our St. Lawrence canals, we would have the right to do that?

Dr. SKELTON: Surely.

Hon. Mr. REID: And that does not mean we would have to always have the canals free?

Dr. SKELTON: "Free" does not mean free from tolls.

Hon. Mr. L'ESPÉRANCE: It means equality.

Dr. SKELTON: Then, the second paragraph of that Article I reads:—

It is further agreed that so long as this Treaty shall remain in force, this same right of navigation shall extend to the waters of Lake Michigan and to all canals connecting boundary waters, and now existing or which may hereafter be constructed on either side of the line. Either of the High Contracting Parties may adopt rules and regulations governing the use of such canals within its own territory, and may charge tolls for the use thereof, but all such rules and regulations and all tolls charged shall apply alike to the subjects or citizens of the High Contracting Parties, and the ships, vessels and boats of both of the High Contracting Parties, and they shall be placed on terms of equality in the use thereof.

Hon. Mr. LYNCH-STANTON: Have they got no further now than giving the rights of navigation in canals connecting boundary waters?

Dr. SKELTON: Canals connecting boundary waters—the Soo canals and the Welland canal.

Hon. Mr. LYNCH-STANTON: How does that connect?

Dr. SKELTON: The waters of Lake Erie and Lake Ontario are boundary waters. It would include the Williamsburg canals, but would not include the Lachine canal.

Hon. Mr. BEIQUE: Nothing below Cornwall?

Dr. SKELTON: Nothing below Cornwall.

Hon. Mr. LYNCH-STANTON: That is as far as they have got now—canals connecting boundary waters—as far as you have read to us?

Dr. SKELTON: Yes.

Hon. Mr. LYNCH-STANTON: They haven't got any rights in any lateral canals?

Dr. SKELTON: No, not under this treaty; not in waters wholly within the territory of either country. Whether or not the previous treaties applied to that would have to be considered. Article I applies to boundary waters and to the statement of liberty of navigation in said boundary waters and any canals connecting boundary waters.

Hon. Mr. LYNCH-STANTON: Am I right in this, that we would not give them the right to go through the Cornwall canal because I do not see how it connects boundary waters?

Dr. SKELTON: The water at each end of the canal would be defined as boundary water.

Hon. Mr. LYNCH-STANTON: I can quite see that the canal between Lake Superior and Lake Huron necessarily connects boundary waters. Now, then,

we have a canal at Cornwall. Some ships traverse the rapids; they come down through the rapids; but is the Cornwall canal one of the connecting boundary waters?

Hon. Mr. REID: No, it is not.

Hon. Mr. LYNCH-STAUTON: I want him to say.

Dr. SKELTON: The question you would ask is, is the river at both ends of the canal in the International section?

Hon. Mr. LYNCH-STAUTON: And connecting boundary waters?

Dr. SKELTON: For example, let us take the Rapide Plat canal. It connects boundary waters. It connects two International sections of the St. Lawrence. The Cornwall canal also, as I recall it, both begins and ends in the International section.

Hon. Mr. LYNCH-STAUTON: Does the spirit and intention of that mean that the Americans may navigate all our canals which run between the top of the lakes and Montreal on our side of the river because they meet the boundary waters?

Dr. SKELTON: Not to Montreal.

Hon. Mr. LYNCH-STAUTON: Say down to Cornwall, if you like?

Dr. SKELTON: I should think so, and equally Canada can navigate United States canals to connecting boundary waters.

Hon. Mr. LYNCH-STAUTON: The word "connecting" is what is troubling me, because I do not see how it connects when you just turn it into the mainland and out again into the river.

Dr. SKELTON: You are of course able to interpret that; that is a question of interpretation.

Hon. Mr. LYNCH-STAUTON: That is assumed to be the proper interpretation?

Dr. SKELTON: I have never seen anything to the contrary. Next, Article II is not particularly pertinent to our purpose. Article II of the treaty provides that each country reserves the control of rivers on its own side flowing into boundary waters. For examples, rivers like the Grand and the Thames in Canada, and the Genesee river in the United States. It provides that if anything is done to them that injures persons below they have access to the courts of the country carrying on the works, and that each Government is to be free to make protests if anything is done in them to affect navigation.

Hon. Mr. LYNCH-STAUTON: That is a curious thing to me. How can a Canadian make up a case for something done on American land, affecting the Canadian side, and sue in an American court or an American sue in a Canadian court? If an American comes over to this side and is endangered by me he can sue in our courts. How can he sue for anything done on his side in our courts?

Dr. SKELTON: The treaty gives the right.

Hon. Mr. LYNCH-STAUTON: I know it gives him the right to sue, but does it give him cause of action?

Dr. SKELTON: That depends on circumstances. He would be allowed to enter a court and plead his case. He would have the same rights in all respects as a citizen of the other country.

Hon. Mr. BEIQUE: I invite you to make it clear to the Committee which provisions of the treaty of 1909 are permanent and which are temporary?

Dr. SKELTON: As far as I am aware, Senator, there are none that are specifically said to be temporary; they are all supposed to be permanent.

Hon. Mr. BEIQUE: The treaty itself, the main treaty, is temporary, only for five years; but the provision you have read—

Dr. SKELTON: No, I don't think so, sir. The treaty may be denounced at the end of five years, but it is not temporary.

Hon. Mr. BEIQUE: The boundary waters are determined for all time to come?

Dr. SKELTON: I will read the article that deals with the terms of the treaty—Article 14:—

The ratifications shall be exchanged at Washington as soon as possible, and the treaty shall take effect on the date of the exchange of its ratifications. It shall remain in force for five years, dating from the day of the exchange of ratifications, and thereafter until terminated by twelve months' written notice given by either High Contracting Party to the other.

So, if it were denounced the the whole treaty would fall; there is no one part of it that would remain.

Hon. Mr. BEIQUE: The boundary waters are fixed for all time to come?

Dr. SKELTON: I do not see that that is so, Senator. I do not see that you can denounce part of the treaty and retain the part you want.

Hon. Mr. LYNCH-STAUTON: The boundary waters are settled by earlier treaties. Forever means for the life of the treaty.

Dr. SKELTON: You may decide to marry a lady forever, but you may change your mind later.

Hon. Mr. LYNCH-STAUTON: You may use all the adjectives you choose, but every nation has a right to denounce every treaty and have war. Lots of them are denounced.

Hon. Mr. McLENNAN: If treaties terminate wars and then they break off after a few years, were they made forever?

Dr. SKELTON: Undoubtedly it is true that as to any treaty where the term "forever" occurs you would find more difficulty in terminating it than otherwise. It indicates the intention to try to maintain it longer; but I do not see that any clause in that treaty or anything defined in that treaty would survive the denunciation provided for in Article 14.

Hon. Mr. LYNCH-STAUTON: Coming back to the matter of a court action. Assume I own a property along the shore of the St. Clair, and assume that the Americans drain that water off for the Chicago canal so as to ruin my property, can I sue in the American courts, and whom can I sue?

Dr. SKELTON: Why that particular river?

Hon. Mr. LYNCH-STAUTON: I am only using that as an example.

Dr. SKELTON: I suppose you would sue either the Federal or the State government or the private company which was carrying on the works. The provision does not apply to cases already existing or covered by special agreement.

Hon. Mr. LYNCH-STAUTON: That is what I wanted to know.

Dr. SKELTON: As a matter of fact that right has not been made use of on either side of the line up to the present time.

Senator BEIQUE, as to your question as to what happens when a treaty includes a term including the phrase "forever," and later provides that it can be denounced in five years?

Hon. Mr. BEIQUE: No, there are clauses that are permanent and clauses that are only temporary.

Dr. SKELTON: That is true, but in case it is specifically so provided. You will find in the treaty of 1871, for example, that there were certain clauses which it was provided could be denounced at the end of ten years and other clauses which were intended to be permanent until the whole treaty was denounced.

Hon. Mr. MURPHY: There is no such thing in the treaty of 1909?

Dr. SKELTON: No, all the clauses are in the same position, except that two of them are underlined by the statement that these rights shall exist forever.

Hon. Mr. BEIQUE: I think I have no doubt as far as it was concerned. I consulted with some prominent lawyers on the question, and they felt that that provision was permanent.

Hon. Mr. LYNCH-STANTON: Suppose they do denounce that treaty, it is gone.

Hon. Mr. BEIQUE: You go to war if you break a treaty that is permanent.

Dr. SKELTON: Article III is the most important Article in the treaty. It provides as follows:—

It is agreed that, in addition to the uses, obstructions, and diversions heretofore permitted or hereafter provided for by special agreement between the Parties hereto, no further or other uses or obstructions or diversions, whether temporary or permanent, of boundary waters on either side of the line, affecting the natural level or flow of boundary waters on the other side of the line, shall be made except by authority of the United States or the Dominion of Canada within their respective jurisdictions, and with the approval, as hereinafter provided, of a joint commission, to be known as the International Joint Commission.

The foregoing provisions are not intended to limit or interfere with the existing rights of the Government of the United States on the one side and the Government of the Dominion of Canada on the other, to undertake and carry on governmental works in boundary waters for the deepening of channels, the construction of breakwaters, the improvement of harbours, and other governmental works for the benefit of commerce and navigation, provided that such works are wholly on its own side of the line and do not materially affect the level or flow of the boundary waters on the other, nor are such provisions intended to interfere with the ordinary use of such waters for domestic and sanitary purposes.

That is the most important article in the treaty so far as its connection with the International Joint Commission is concerned. A later article, Article VII, agrees to the formation of an International Joint Commission consisting of three members from each country; and Article VIII gives the International Joint Commission the jurisdiction to pass upon the cases mentioned in Article III which I have just read, and the cases covered in the following article, which deals with obstructions in rivers flowing from the boundary. A great majority of the cases which have come before the International Joint Commission have been based on this Article III. Most of them have dealt with questions raised by either or by both countries as to the advisability of works along the boundary waters, sometimes on one side and sometimes on the other and sometimes on both sides, but in either case affecting the level of the boundary waters on both sides of the line.

You spoke some time ago of wishing to call the secretary of the International Joint Commission. He is in Europe and will not be back until this session is over. I am not familiar with the details of the work of the Commission, but if there are any questions along broad lines about the cases that have come before the commission, I could try to have the facts looked up.

Hon. Mr. LYNCH-STAUTON: I think they disposed of the question of taking power out above Niagara Falls and turning it in below Niagara. Did they say that that did not affect navigation; that it had nothing to do with it?

Dr. SKELTON: That was specifically provided for by Article V.

Hon. Mr. LYNCH-STAUTON: Did the Commission think they had anything to do with that?

Dr. SKELTON: The Niagara river?

Hon. Mr. LYNCH-STAUTON: Yes.

Dr. SKELTON: No. That does not come before the commission because it is dealt with in a separate article by special agreement between the two countries.

Hon. Mr. LYNCH-STAUTON: To protect the scenic conditions?

Dr. SKELTON: The primary purpose was to protect the scenic qualities.

Hon. Mr. LYNCH-STAUTON: It is all treated under that head, is it? Now, there was a man who has written an article. He said he was a member of the commission in Washington, and on that commission they specifically approved of the diversion in Chicago?

Dr. SKELTON: The old International Waterways Commission—

Hon. Mr. LYNCH-STAUTON: I mean the International Waterways Commission specifically approved of it.

Dr. SKELTON: I will be glad to go into that point a little later. It might perhaps help to indicate the scope of this article by referring to some of the cases based upon it which have come before the International Joint Commission. Article III applies only to boundary waters as defined in the first article. Now, as to those boundary waters. In the first place, if the two governments concerned make a treaty or otherwise make a special agreement, that covers the whole ground (either by reciprocal legislation or by a treaty)—the International Joint Commission does not come in at all.

Hon. Mr. LYNCH-STAUTON: They can include that body.

Dr. SKELTON: They can include the International Joint Commission. In the second place, suppose they do not make any special agreement, and suppose the Government of Canada on its own side of the line wants to construct some works, then, if it is clear that these works will not materially affect the level of the waters on the other side of the line it is at liberty to go ahead without referring it to the International Joint Commission; but, of course, the question may come up whether or not it is right in its view that these works will not materially affect it. If both countries agree that the works in question will not materially affect it, the matter would not ordinarily be referred to the International Joint Commission. I may give an instance of that. In 1918 the United States proposed to dredge some channels in the River Detroit which it contended would not materially affect the level of the waters on the other side, but they said that if the Canadian Government did not agree with this opinion they would be quite prepared to have the matter referred to the International Joint Commission. The Canadian Government engineers looked into the matter; they agreed the works would not materially affect that level but suggested a couple of points in which the plans might be amended. Both points were accepted by the United States and the works, therefore, were gone ahead with without reference to the International Joint Commission.

You may then, in the first place, have a treaty or other agreement between the two countries which would entirely supersede any reference to the Joint Commission. You may, in the second place, have a discussion regarding governmental works which the government in question thinks would not materially affect the waters on the other side of the river, and if that is agreed to by both governments the matter does not come to the International Joint Commission.

Then, in the third place, you have those proposed works which quite clearly do affect the level of the waters on both sides of a boundary section. For example, in the Soo when it was proposed by the Michigan Northern Power Company on one side and by the Algoma Steel Company on the Canadian side to extract more water for power, it was quite obvious that that withdrawal would affect the level of the boundary waters, and that matter was, therefore, referred to the International Joint Commission in 1913 or 1914. The Commission laid down the rules under which the temporary diversion was to be made and suggested the appointment of an International Control Board consisting of one engineer from each side to supervise, as Mr. McLachlan told us the other day, and that regulation has been in force ever since.

Then, take the case of the St. Clair river. A couple of years later in 1916, the United States proposed to do some dredging on its own side of the river and to erect a submerged weir across the river, part of it in Canadian waters. The question was, therefore, referred to the International Joint Commission for report. The Commission made certain recommendations which were accepted by both governments and have since gone into effect. The dredging in that case was on the United States side of the river and the weir in question was on both the United States and the Canadian sides.

Then, down on the St. John river, the New Brunswick Electric Power Company and the St. John River Electric Power Company both wanted to construct works on the River St. John on the New Brunswick side which would affect the level of waters in the international area of the St. John river, and they, therefore, applied to the Commission, which gave them permission subject to certain regulations. A little earlier than that the St. Croix Water Power Company had made certain diversions on the Maine side without applying to the Commission, thinking its license from the Maine government was sufficient. It afterwards made application and its project was approved.

Another proposal that came before the International Joint Commission dealing with boundary waters was the Massena weir proposal at the Long Sault. There the Commission had held that they had jurisdiction because of the fact that the weir in question would affect the level of the boundary waters, and the commission issued a temporary permission for the construction of the weir which has been continued under somewhat varying conditions until the present time.

Those are typical cases which have come before the International Joint Commission. In all of these the commission has had jurisdiction because the works which it was proposed to construct were in boundary waters, and would quite clearly—there was no doubt about the evidence—affect the level of the boundary waters on the other side of the river.

Hon. Mr. MURPHY: There was something in regard to the building of the Peace bridge between Buffalo and Erie.

Dr. SKELTON: Yes, the question arose whether the piers in the river would be sufficiently serious to affect the level of navigation. The matter was referred to both countries, and it was thought by the governments of both, after engineering investigation, that the effect of the piers was so slight as to not warrant any action.

Hon. Mr. REID: With regard to the weir at Massena, didn't the United States Government take the position that the International Joint Commission had no power; they gave the authority to them after proceeding with the work?

Dr. SKELTON: The War Department, which is their engineering body, gave authority to proceed, subject to the approval of the International Joint Commission. They had also given authority for doing some dredging in the same district.

Hon. Mr. REID: When they made that application there was the dredging of the weir and there were three things that the War Department gave them permission to proceed with. They did not notify the Dominion Government that they had given this authority at all. The Dominion Government heard of it.

Dr. SKELTON: If you care I can go into that later.

Hon. Mr. BEIQUE: Is the jurisdiction of the Joint Commission dependent upon the action of both governments, or are there matters in which they have jurisdiction without any reference being made to either or both governments? Can they act at the instance of one government alone in certain cases? Can they act on their own motion?

Dr. SKELTON: They never act of their own motion, but they always act on a question being brought before them by one or both governments. There are cases in which they can be set in motion by reference from one government only.

The Committee then adjourned until 4.30 o'clock in the afternoon.

AFTERNOON SESSION

WEDNESDAY, 9th May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, resumed at 4.30 o'clock p.m.

The Honourable C. E. Tanner, presiding.

Dr. O. D. SKELTON, Under-Secretary of State for External Affairs, was recalled.

Dr. SKELTON: Mr. Chairman, I do not think what I have to say on the subject will detain you much longer. As I understand, the first point that you wished dealt with was one of the cases which came up under Article III of the Boundary Waters Treaty. Just before lunch we had noted that the International Joint Commission had been called upon under the terms of Article III of the Boundary Waters Treaty to deal with the question of obstructions or diversions in boundary waters at a number of points, ranging from Sault Ste. Marie down to the River St. John.

Senator Reid referred to one of those cases, the Massena Weir case, and asked for some further discussion on that point. I assume, honourable gentlemen, that you are all familiar with the very full and clear statement which Senator Reid himself made on the subject in the Senate a few days ago, and I need not go into it except very briefly.

In the international section of the River St. Lawrence, just south of Long Sault Island, the St. Lawrence River Power Company, originally the St. Lawrence Power Company, which later became a subsidiary company of the Aluminum Company, began, under a charter which it got from the State of New York, in 1896, to divert water from the south branch of the St. Lawrence River into the River Grass, which served as a tailrace to carry it into the St. Lawrence, and a very considerable amount of power was developed at the town of Massena, at the junction point.

In 1917 this company applied to the United States for permission to do a certain amount of dredging up here (indicating), and particularly to be allowed to construct a submerged weir across from the main shore of the United States

to Long Sault Island, which is also United States territory. The Secretary of War, as the engineering Department of the United States Government, gave a permit for the latter purpose, the construction of the submerged weir, subject to the approval of the International Joint Commission.

Nothing was done for some time towards bringing the matter before the International Joint Commission. In the fall of 1918 the plea was made that further power was necessary, particularly in winter-time, in order to enable the Aluminum Company, whose works are at Messena, to produce the aluminum badly needed for the Allies. They were then producing about 95 per cent of what the United States needed and about 60 per cent, as I recall it, of what Great Britain was using. On the plea, then, of war emergency the company brought their case before the International Joint Commission, asking to be allowed to construct the work in question, the submerged weir, on the ground of emergency. The matter was not formally brought to the attention of the Canadian Government, as Senator Reid noted, before the hearings of the Commission itself had begun. It was considered that there was a very great emergency and the ordinary procedure was rather telescoped.

In the hearings which the International Joint Commission held on that application considerable difference of opinion developed between the Canadian Government and other parties interested. Representatives of the Canadian Government, particularly Hon. Hugh Guthrie, who appeared before the Commission, and Mr. Keefer, and also Minutes of Council of the Canadian Government, objected to the International Joint Commission dealing with this subject at all, contending that it was a matter for adjustment between the two Governments, rather than for action by the Joint Commission. They made it clear that they were not necessarily objecting to the construction of a weir for aluminum purposes, and suggested that it might be possible in direct discussion between the two Governments to arrange for the construction of such a weir, provided it were not to continue materially beyond the termination of the war, and provided it were not made an excuse for diverting more water from the river; and they suggested further that instead of going ahead in an isolated way to develop the power of the Long Sault, what should be done was that the United States Government and the Canadian Government should get together and make a joint arrangement for the development of that power. That was their first suggestion—that it was a matter for discussion between the two Governments on some such terms.

Counsel for the Canadian Government made the further objection to this proposal that they considered that it violated the terms of the Ashburton-Webster Treaty of 1842, to which reference was made this morning. Article VII of that Treaty, you will recall, stated:—

It is further agreed, that the channels in the River St. Lawrence on both sides of the Long Sault Islands and of Barnhart Island. . . shall be equally free and open to the ships, vessels and boats of both parties.

Now, it was urged very vigorously by Mr. Guthrie that if you constructed a submerged weir, which is practically a dam under water, across the south channel, it closed that channel absolutely to navigation by Canadian vessels, boats and ships, and was a violation of Canadian rights under the Treaty of 1842. On the other hand, it was argued by United States counsel that this phrase, "equally free and open to the ships of both parties," meant that there was to be no discrimination, and if it was closed against the United States vessels as well as against Canadian vessels, and if the other channels were open for navigation, and if as a matter of fact this south channel was not used for navigation except by pleasure boats, there was no violation of the Treaty.

Now, I understood from Senator Reid's question that he raises the point whether the International Joint Commission in dealing with this matter had not gone beyond its jurisdiction, and whether that might not raise the apprehension that in other parts of the river it might equally go beyond what had been understood to be its jurisdiction. Well, it is certainly a debatable question, but as I recall the judgment given in the case, the International Joint Commission, which gave a unanimous verdict on this subject, took this ground. They said: "Here is a war-time demand about which there is no question. It has been certified to by the United States War Department and other bodies. The Canadian Government does not object to the substance. It would be prepared to agree to a temporary arrangement if that could be effected. The United States Government showed that they could not get an immediate arrangement by treaty, because the Senate was not in session, and its assent would be necessary. So the question was up to the International Joint Commission, assuming that it had jurisdiction to deal with it at all. The Commission said: "We have no doubt that we have jurisdiction. These works would undoubtedly raise the level of the water on the other side of the river, and under Article III this clearly brings the matter within our jurisdiction. You could take it out of our hands by a joint agreement between the two countries, but, seeing that that is not possible in the time limit that is set by our necessities, then it falls to us to deal with it." They said in substance: "We agree it is a very doubtful point whether, in exercising this jurisdiction which we think we have, we should rule that the Ashburton-Webster Treaty bars the construction there of any dam or weir that would interfere with navigation. It is open to question just how that Treaty is to be interpreted." The Canadian representatives had said that there must be absolutely no barrier to navigation. The United States had said that it simply meant that there should be no discrimination against either party, and that in any case it was conceivable that that Article no longer held good, in view of the negotiation of the 1909 Treaty. So, in view of this uncertainty and these arguments on both sides, the Commission said: "We do not think we should settle the question definitely at the present time. We will give a temporary and interim ruling, and then if the question comes up again we can have it fully argued on their constitutional aspect at a later time." So they issued an interim order permitting the company to construct the weir, on the understanding that this order was to remain in force for five years or until the end of the war, whichever should be the longer, and should then come up for review.

It did come up for review, and the matter again came before the Canadian and United States Governments for consideration. The Canadian Government in 1922 took the ground that they must insist on maintaining all the objections which had been raised by the Canadian Government in 1918, as a matter of right, that that subject to certain conditions we would not object to a temporary extension of the permit. Those conditions included provisions to make sure that no more water was diverted than was being diverted, and guarantees against injury to Canadian navigation interests on the other side of the river, at Farran's Point and Cornwall Canal.

Hon. Mr. REID: Was it the Government or the Commission that took that attitude?

Mr. SKELTON: The Government took that position first, Senator. And the Commission, after full consideration, issued a further temporary order, incorporating all the suggestions of the Canadian Government, providing that the permit for the weir, under those conditions of regulation that I have mentioned, and under the supervision of two engineers, one Canadian and one United States, should continue in force until such time as either Government brought the matter to the attention of the Commission again and gave six months' notice of a

desire to terminate the arrangement. In that case the Commission would go into it later and decide on the point.

To complete that very hurried summary, I might add that about three months ago the St. Lawrence River Power Company brought another application before the International Joint Commission, on this occasion wishing to have this submerged weir made permanent and raised above the surface.

Hon. Mr. MURPHY: How much above the surface?

Dr. SKELTON: Raised six feet, I think it was. How much was it?

Mr. McLACHLAN: Six feet.

Hon. Mr. MURPHY: That is right.

Dr. SKELTON: The Canadian Government at once had the matter looked into by engineers of the Railways and Canals Department, and informed the Commission that they must ask for a postponement of the hearing, and that when the hearing was held they would file a statement in response.

The International Joint Commission, at its meeting in Washington last month, was prepared to grant an extension accordingly, but the representatives of the company took the ground that if they were not able to go ahead with it at once they might perhaps find it advisable not to go ahead at all this year, and they expressed their agreement to an adjournment *sine die*.

So that is, as far as I know, the way the matter stands at present. I do not think it is necessary to go any further, gentlemen, into the cases that have come up under Article III.

Hon. Mr. REID: I want to mention just one matter. So far as this whole question is concerned, the arguments of Mr. Guthrie and Mr. Keefer are in the records.

Dr. SKELTON: Yes.

Hon. Mr. REID: And I will not discuss them, because it was to those arguments that I made reference. But there is a point there. You stated that the application had been submitted by the Aluminum Company to the United States Government in 1918.

Dr. SKELTON: 1917. - No!

Hon. Mr. REID: If I remember rightly, it was for war purposes that they put in the application. Of course, Mr. Guthrie's remarks will explain that.

Dr. SKELTON: Yes.

Hon. Mr. REID: In 1917 they wanted to do the work for war purposes. It was an emergency case, but it was never brought up or dealt with for practically a year.

Dr. SKELTON: That is quite right.

Hon. Mr. REID: I mean, the fact of delaying that for a year shows that it did not turn out to be a case of emergency as they first represented.

Dr. SKELTON: I think I indicated there was a delay. A good many corporations, of course, find a silver lining to any war.

To pass, then—

Hon. Mr. McLENNAN: Before you pass from that—does the water used by this Aluminum Company come back into the St. Lawrence?

Dr. SKELTON: Yes, it comes back through the Grass River into the St. Lawrence here (indicating). It is diverted through the canal down to the River Grass, and then back into the St. Lawrence just at the head of Cornwall Island.

Hon. Mr. McLENNAN: Thank you.

Dr. SKELTON: Of course it will be realized that this was a diversion in international waters and would not be comparable to any question that might arise in the purely Canadian section.

Hon. Mr. REID: To whom was the application made, do you know, Dr. Skelton, to grant permission for that canal from the South Sault, to develop the power at Massena?

Dr. SKELTON: This canal?

Hon. Mr. REID: Was that granted by the Canadian Government?

Dr. SKELTON: No; as far as I know, Senator, the charter was granted away back in 1896, but there was no treaty governing the matter.

Hon. Mr. REID: I mean, there was no correspondence with Canada?

Dr. SKELTON: No.

Hon. Mr. REID: They went ahead?

Dr. SKELTON: The charter was granted by the State of New York. There was a long law suit over it, but they went ahead and built it before the Treaty was made.

Hon. Mr. BEIQUE: There was no Canadian legislation?

Dr. SKELTON: No.

Hon. Mr. REID: No legislation, nor any request made to Canada?

Dr. SKELTON: No. There was no Treaty then. If an application had been made for permission to build the proposed canal after 1909, it would have had to come before the International Joint Commission before the canal could be built.

Hon. Mr. WILLOUGHBY: When was it built?

Dr. SKELTON: The charter was granted in 1896.

Hon. Mr. WILLOUGHBY: It was built thereabouts?

Dr. SKELTON: The building began in the next three or four years. The first company that built it went bankrupt, and it was taken over about 1906 or '7.

Hon. Mr. REID: What is the difference between 1909 and the time previous to that? As I understood that Treaty, there was to be no diversion of either side except for their own purpose. That is, on either side they could do it.

Hon. Mr. LYNCH-STANTON: How many second feet do they take there?

Mr. McLACHLAN: About 25,000.

Hon. Mr. LYNCH-STANTON: Twenty-five thousand feet a second.

Dr. SKELTON: I am sorry. I missed the question you asked.

Hon. Mr. REID: There is in the Treaty a clause which says that so long as it does not interfere, either country can develop navigation or any other works without consulting the other country.

Dr. SKELTON: Not necessarily. You are referring to the second part of Article III, as to governmental works, Senator. Ordinarily, as we noted, any diversion from boundary waters which would affect the level on the other side of the river must be done either by agreement between the two countries or by reference to the International Joint Commission.

Hon. Mr. REID: Now?

Dr. SKELTON: Now. So if this application had come up—if the construction of this canal had been proposed after 1909, it would necessarily have had to be referred to the Joint Commission or have been dealt with by a separate agreement between the two countries.

Any other question on that Article?

Hon. Mr. BEIQUE: I have not had occasion to examine these questions, but who can deal with them as far as Canada is concerned? Are these questions settled with the American Government by Order in Council? At first

glance I should think that legislation would be required, as a Treaty must be approved by Parliament.

Dr. SKELTON: Surely, if a Treaty were required; but not if it simply amounted to a statement by the Canadian Government, for example. Suppose the United States were proposing to do some work on its own side and asked us whether we thought that the matter needed to be referred to the International Joint Commission. Well, if the Canadian Government's engineers reported, "No, this will not affect the water on our side of the river one-quarter of an inch," the Canadian Government would simply say so.

Hon. Mr. BEIQUE: But no agreement—

Dr. SKELTON: No agreement could be entered into, of course.

Hon. Mr. BEIQUE: Without Parliament?

Dr. SKELTON: Without Parliament's consent.

Hon. Mr. REID: I want to ask a question there. You said a few minutes ago, with regard to the Massena canal, that when they were developing that power they got a charter from New York State and acted on that.

Dr. SKELTON: Yes. They later got certain permits from the Secretary of War also.

Hon. Mr. REID: But they went on and did it without consulting the American Government at the time? You see, you are saying—

Dr. SKELTON: So far as the charter for constructing the canal was concerned, they had to get the consent of the Secretary of War for certain jetties that it was held might affect navigation.

Hon. Mr. LYNCH-STAUNTON: That is all.

Dr. SKELTON: Yes. The United States Federal Government now exercise, I should say, Senator, a great deal more control over power and navigation development in navigable rivers than they used to exercise some years ago.

Hon. Mr. LYNCH-STAUNTON: In the War Department?

Dr. SKELTON: Through the War Department, or the Federal Power Commission.

Hon. Mr. REID: I think they have since got a charter from the United States Government as well as New York state, covering the power.

Dr. SKELTON: They got certain permits at least.

Hon. Mr. WILLOUGHBY: They got on using that power now, without any particular protest on our part?

Dr. SKELTON: Yes. I assume the question will come up before whatever Government is considering the matter, when the whole question of the development of the St. Lawrence is up. It may not be considered worth while to deal with it piecemeal. Obviously the full development of the St. Lawrence would to a considerable extent replace that existing development.

Next, Article IV of the Boundary Waters Treaty provides that the High Contracting Parties "will not permit the construction or maintenance on their respective sides of the boundary of any remedial or protective works or any dams or other obstructions in water flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary, unless the construction or maintenance thereof is approved by the aforesaid International Joint Commission."

Now, to illustrate that. Out in British Columbia, on the River Kootenay, which flows in and out between Canada and the United States, there is a development proposed on the Canadian side, which is the lower side (the river flows from the United States into Canada at that point)—a development consist-

ing of certain reclamation and irrigation works. That matter, therefore, had to go before the International Joint Commission, which considered it at its last two meetings and is dealing with it now. That is one instance that might be given of a reference to the Commission under this clause.

Article V deals with the question of the division of power at Niagara. In that connection the question was raised this morning as to the Chicago diversion. I do not think it is necessary for me at this stage to go into any of the general aspects of the Chicago diversion, but the particular question that was raised was whether Canada had not committed itself to accepting a diversion of 10,000 cubic second feet at Chicago, in return for the margin which it received in the unequal division at Niagara. That point was raised, and I might discuss it very briefly.

The position has been taken that Canada committed itself to accepting this diversion, and the grounds on which that is based are certain statements by Secretary Root of the United States, and the report to which Senator Lynch-Staunton referred this morning, of the old International Waterways Commission, which casually or incidentally, in referring to the division of water that was proposed at Niagara, said: "In addition to the other reasons for a greater share going to Canada, we may mention the fact that there is at present—as an actual fact—10,000 cubic second feet diversion at Chicago."

Personally, I do not think there is any ground for the contention that in Article V of the Boundary Waters Treaty we committed ourselves in regard to the Chicago diversion, in any shape or form, for this reason. If you will read Article V you will note it says:—

The High Contracting Parties agree that it is expedient to limit the diversion of waters from the Niagara River so that the level of Lake Erie and the flow of the stream shall not be appreciably affected. It is the desire of both Parties to accomplish this object with the least possible injury to investments which have already been made in the construction of power plants on the United States' side of the river under grants of authority from the State of New York, and on the Canadian side of the river under licenses authorized by the Dominion of Canada and the Province of Ontario.

Then it goes on:

The United States may authorize and permit the diversion within the State of New York of the waters of said river above the Falls of Niagara, for power purposes, not exceeding in the aggregate a daily diversion at the rate of twenty thousand cubic feet of water per second.

And it goes on to say that Canada is to have thirty-six thousand cubic feet of water per second.

Hon. Mr. LYNCH-STAUNTON: Why was Canada given sixteen thousand feet per second more than the United States?

Dr. SKELTON: The reason is plain on the face of it. It is stated right in the article. In the first place the two countries agree that it was desirable, for the preservation of the levels of Lake Erie and the scenic beauties of Niagara Falls to limit the total diversion that could be made. The average flow of Niagara Falls was about 220,000 cubic second feet, and they concluded that nothing more than a quarter of that could be diverted without injury to the falls, about 55,000 feet. Then the next question was how should that be divided between the two countries, and there the determining factor was this; there were already on the Canadian side plants in construction which would require about 32,000 to 33,000 cubic second feet. On the United States side the plants under construction would not require more than half of that amount. That was the plain and obvious reason. They were compelled to limit the total that

could be diverted, and they fixed it at 55,000 second feet—actually 56,000 cubic second feet, and they said, “We will take into account simply those plants that are now under construction—with the least possible injury to investments which have already been made in the construction of power plants on the two sides”; and so they recommended that the Canadian power plants, which were much farther ahead, and which—

Hon. Mr. LYNCH-STAUNTON: Were owned by Americans.

Dr. SKELTON: —and that they should be given a greater amount.

Hon. Mr. BEIQUE: Was not another factor that the natural flow of the water was greater on the Canadian side than on the American side?

Dr. SKELTON: That was mentioned also, and I think, in the popular consideration, that was an effective argument. It has been pointed out, however, that a quarter of a mile above the falls it is a fifty-fifty division, but at the falls much more comes on the Canadian side.

Hon. Mr. BEIQUE: Artificial works would have to be made to change the flow of water.

Dr. SKELTON: Yes. Now, is there any question on that point?

Hon. Mr. MURPHY: According to the terms of the text that you have just read, the answer as read by you was concurred in by the United States government?

Dr. SKELTON: Exactly; that was the official reason that the Article V of the Treaty was made and subscribed to by the two governments. They put it down in black and white; that is the only reason that is there, and any suggestion that might have been made beforehand was just up in the air.

Hon. Mr. McMEANS: The diversion at Chicago was wholly unauthorized so far as Canada is concerned; is that the idea?

Dr. SKELTON: Certainly; the Canadian government has never at any time consented to it.

Hon. Mr. McMEANS: And they have never been asked to?

Dr. SKELTON: No. The Treaty, it is true, did not by specific reference forbid the diversion, but neither did it authorize it. Chicago has contended that Article II of the Treaty authorized the diversion, in the clause which reads:—“This provision shall not apply to cases already existing or to cases expressly covered by special agreement between the parties hereto.” If any diversion were so authorized, it would of course be merely the legal diversion at that time, 4,167 c.s.f. But on this point it will suffice to quote the authority of the United States Government. In the brief which the United States, as appellee in the Supreme Court case of *The Sanitary District of Chicago vs. The United States*, submitted in 1924, the Chicago contention is thus dealt with (p. 226):—

QUOTATION FROM U.S. BRIEF

It is difficult to treat patiently assertions such as are made by counsel for appellant with regard to the intent and effect of the Treaty....

That 10,000 c.s.f. was not an “existing diversion” is apparent from the testimony as to the actual diversion by appellant from 1900 to 1913. (See Statement of the Case, p. 69.) In 1907 appellant was withdrawing 6,444 c.s.f.; in 1910, 7,132 c.s.f. As a matter of fact, as late as 1909 the appellant refused to inform the International Waterways Commission what it was withdrawing. In the report of the Commission of January 8, 1910, it is stated:—

In 1900 the Chicago Drainage Canal began diverting water from Lake Michigan. The amount diverted between January, 1900, and June, 1904, inclusive, was computed from data furnished by

the U.S. Engineer Office at Chicago. The flow through the canal since June, 1904, has been assumed to be 4,167 cubic feet per second, the quantity authorized in the permit of the Secretary of War. It is believed to have been greater, but the difference is not sufficient to vitiate the results sought for here. An application by the Commission to the Sanitary District of Chicago for a copy of their record met with a refusal to furnish it. (Rec. Vol. VII, p. 253.)

Let us now examine the provisions of the Treaty. Article II, quoted in Appellant's Brief (p. 189) preserved the right of citizens of one country to sue in the courts of the other country for damages as to any injury caused by a diversion with the proviso—

"but this provision shall not apply to cases already existing or to cases expressly covered by special agreement between the parties hereto."

Let us assume that this provision prevented any individuals in Canada from suing for an injury caused by an existing diversion. The appellant's diversion of 10,000 c.s.f. was not an existing diversion. It actually was diverting 6,970 c.s.f. which it was concealing from the knowledge of the International Waterways Commission. Its authorized diversion was 4,167 c.s.f. which that Commission assumed to be the then flow through the canal. In interpreting the word "existing" as it appeared in the Treaty, were not the negotiators of it justified in assuming that the appellant was obeying the law? The question of an increased diversion had not theretofore been raised directly except by the appellant's application for a permit to divert 4,000 c.s.f. through the Calumet River. This had been denied. Of course, it was known that some day the appellant might ask for 10,000 c.s.f. but it was more than doubtful that the Secretary of War, having refused the Calumet application because of its effect on the lake levels, would ever grant permission to divert this amount.

Furthermore, the right of individuals to sue is a very different matter from the right of their respective governments in international law. This is apparent from the second paragraph of Article II of the Treaty, which is as follows:

"It is understood, however, that neither of the High Contracting Parties intends by the foregoing provision to surrender any right which it may have to object to any interference with or diversions of waters on the other side of the boundary the effect of which would be productive of material injury to the navigation interests on its own side of the boundary." (Appellant's Narrative, p. 532.)..

Where does the Treaty authorize or "protect" the Chicago diversion? Article II expressly reserves to the United States exclusive control over diversions from Lake Michigan, so long as there is no material injury to Canadian navigation interests. The United States, by entering into the Treaty, did not contract to maintain either the existing diversion of 4,167 c.s.f. or a future diversion of 10,000 c.s.f.

Dr. SKELTON: I do not think it is necessary to go into every article of the Treaty, but I might refer to article IX, which gives either government the right to bring before the International Joint Commission any matter that they would like to have investigated and have a report made on it by the Commission. Under that article, for example, the question of the levels of the Lake of the Woods were examined into by the International Joint Commission, and they made a report which was eventually accepted as the basis of the Treaty between

the United States and Canada and is in force to-day. The examination by the International Joint Commission of the St. Lawrence Waterway was under this article.

Hon. Mr. MURPHY: What about the Milk River?

Dr. SKELTON: Article VI refers to the St. Mary's and Milk Rivers, which have been satisfactorily adjusted up to the present. These, I think, gentlemen, are the chief features of the Treaty regulations bearing on the question. A good many points in them are questions of interpretation, and each of you will interpret those documents in the light of your own experience and knowledge of constitutional affairs. I do not think I have anything further to add unless there are some questions.

The CHAIRMAN: Are there any other questions to be asked? We are very grateful to you for your statement, Dr. Skelton.

The CHAIRMAN: Mr. McLachlan is here now.

D. W. McLACHLAN, Esquire, Engineer in charge St. Lawrence Waterways, Department of Railways and Canals, Ottawa, was recalled.

Hon. Mr. McLENNAN: Before you begin the main current of your address, Mr. McLachlan, would you clear up a part for me, as to whether the main channel passes on the north side of Barnhart Island?

Mr. McLACHLAN: On the south side. On the north side of Barnhart Island a boat could only go down there with a few feet of draught. There is a natural weir right across the river near the foot of Sheek and Barnhart Island, and a rough rapid with a few feet of water.

Hon. Mr. McLENNAN: The main part of Barnhart Island is in American territory?

Mr. McLACHLAN: Entirely American territory. The channel used by boats is south of Barnhart Island.

Hon. Mr. DANDURAND: What has been done on the diversion of the St. Lawrence?

Mr. McLACHLAN: Before 1917 the Aluminum Company canal drew its water from a point in the south channel two or three feet below the level at the head, and though the diversion was considerable—20,000 second feet at that time—it had very little effect on the water level above, due to the action of a natural weir at the upper end of Long Sault Island, over which there was a depth of about 12 feet. In 1918 they dredged away Dodger shoal, and that produced a condition where the draft in the canal very materially affected the water level at the head of the Island and it also affected very materially the amount of water that went down over the control on the other side of Long Sault Island. Up till about 1918 the drift had very little effect on the water levels north of Long Sault Island, but after that date it had a great deal of effect. Of course the diversion of water through this Massena Canal always did affect the levels from the head of Barnhart Island down to the head of Cornwall Island more than it did in the reach above, because the water that flowed in the Grass River, of course, could not flow in the main channel of the river.

Hon. Mr. DANDURAND: But there was very little navigation on that?

Mr. McLACHLAN: There is very little navigation south of Long Sault Island. Originally it was the square timber that went down that channel. In the square timber days it was very important, because they could not go down any other way. But after the disappearance of the rafts this became simply a

motor-boat channel, and even the R. & O. boats, the passenger boats, went down north of Long Sault Island, which was an international channel, and passed into an all-American channel at the head of Barnhart Island, and continued in the American channel till the foot of Barnhart Island; then they passed into an international channel.

Mr. McLACHLAN: In discussing economics I would like, just for a minute, to refer to the various routes that are available for a deep water way from the Great Lakes to the ocean. As you know, the Americans have been considering quite a great deal a deep waterway from Lake Ontario via Albany to New York, and a report was made two or three years ago by the War Department engineers on that project. That is the only serious rival the deep waterway project has.

Hon. Mr. McMEANS: Is that the state of New York canal?

Mr. McLACHLAN: No, the state of New York canal is shown blue on the diagram. As you know, it was an old canal built in the beginning of the century, and it has been greatly enlarged. The last enlargement was made between 1905 and 1918. It is supposed to be 12 feet deep. It has cost about \$175,000,000. The canal is only 75 feet wide, and it has hundreds of bridges, with only fifteen feet head room. The canal between Buffalo and New York has 35 locks, 170 miles of canal only 75 feet wide, 179 miles of river channels less than 200 feet wide, 100 miles of open river and 27 miles of lake navigation. The canal costs the state of New York about \$10,000,000 per year and the total benefits are supposed to be about \$1,500,000 per year. Its failure is due to the low headroom provided at bridges and the great length of narrow canal.

The American people have been considering lately whether a deep waterways should or should not use our Welland canal as a part of it. The reason some do not want to use it is because it would not then be an all-American canal. However you may assume, I think, that they will use our Welland canal between Lake Erie and Lake Ontario. If they do this the project would be that of building of a new canal from Oswego, roughly following the barge canal to Albany, and down the Hudson river to New York. Their estimated cost is \$506,000,000 for 25 feet depth.

Hon. Mr. BEIQUE: Can they do that without any diversion?

Mr. McLACHLAN: They propose to feed the canal by tapping some of the rivers that flow into Lake Ontario in one scheme and by making Oneida lake water flow both ways in another. If they do this they will be doing the same thing as Chicago is doing if Lake Michigan is taken as not being a boundary water. There is an article in the treaty which says they can do that.

Hon. Mr. HUGHES: They would be doing that?

Mr. McLACHLAN: It is treated differently from diversions from boundary waters in the treaty. It says they can do it, but I think they are liable for the damages that does.

Now, another thing to note in connection with the transportation question is that the United States Government, in co-operation with the port of Albany, are now developing an ocean terminal at Albany and are deepening the Hudson river up to Albany so as to give a depth of 27 feet. That port will be a rival of Montreal in the near future. It will have a navigation season that will be a month longer than the navigation season below Montreal. Nevertheless, it will be a seasonal port, because around Christmas time the Hudson river covers with ice about halfway down.

Hon. Mr. DANDURAND: About Poughkeepsie?

Mr. McLACHLAN: I think you are right. I was there and I enquired about this matter but I forget the names of the places.

Hon. Mr. L'ESPERANCE: Do they develop any water power there?

Mr. McLACHLAN: No, none whatever.

The United States Government engineers turned in an economic analysis, showing the relative merits of these two projects. I can give you the name of the document. It is: "House of Representatives Document No. 228, 69th Congress, First Session; Waterways from the Great Lakes to the Hudson River." They show not only the estimated cost of the project, but its relation to the St. Lawrence in the way of economics and rates, to be secured by its use. Action on that matter has been held up, pending negotiations with Canada on the St. Lawrence Deep Waterways project, I would say.

Now, the low level route as described by them rises 140 feet from Lake Ontario to a summit level, and then locks down 386 feet to the sea level at Albany. They have another scheme called the high level scheme. It locks up 170 feet and down 416 feet.

Hon. Mr. DANDURAND: What is the length of it?

Mr. McLACHLAN: The length is 173 miles Oswego to Albany and 140 miles Albany to New York. It has 128 miles of restricted canal compared with the St. Lawrence's 25. It has 20 locks compared with 9 on the St. Lawrence, and 54 bridges, compared with 8 on the St. Lawrence. It might have a little longer season of navigation than the St. Lawrence Waterways would have, because, as you know, the water from Lake Ontario to the sea is cooled by the exposure and by the Ottawa water, so the ice forms at Sorel earlier than anywhere else on the route.

It might have a larger traffic than the St. Lawrence and if operated free of tolls, would perhaps give slightly cheaper transportation, because rates out of New York are less than out of Montreal.

I made an investigation of this route four or five years ago and it showed me that that route would pay interest on its cost. It would be a very much better paying proposition than our Georgian Bay canal, and is the closest competitor of the St. Lawrence.

Hon. Mr. HUGHES: What is the proposed depth of that canal?

Mr. McLACHLAN: 25 feet. Costs were also given for 27 feet and 30 feet.

Some four years ago, 1922-23, I went very carefully into the question of economics, and prepared a preliminary report on that subject, which now, of course, is quite useless. A few months ago I asked Mr. Lindsay and Mr. Moore of my staff to put this material together in a form that would be applicable to the present costs as we give them in our reports. I thought I might give you the balance sheet, and then discuss how it is made up.

ST. LAWRENCE WATERWAYS PROJECT

TABLE SHOWING ANNUAL CHARGES AND BENEFITS FROM DEEP WATERWAYS PROJECT

Scheme—Crysler Isd. Project in International Rapids Section.

Hungry Bay—Melocheville Project in Soulanges Section.

A. Overall Cost.

Section	First Cost	Interest during Construction and Marketing Period	
Thousand Isd.	\$ 1,100,000	\$ 55,000	
International Rapids	271,814,000	72,164,000	
Lake St. Francis	980,000	25,000	
Soulanges	33,640,000	2,555,000	
Lachine	53,000,000	6,890,000	
Total	\$360,534,000	\$81,689,000	\$442,223,000

B. Annual Charges of St. Lawrence Project. Upper Lake channels improved for upper lake navigation free of charge to St. Lawrence Project.

Interest on 1st cost—5 per cent on \$360,534,000	\$18,027,000
Interest on interest during construction, 5 per cent on \$81,689,000	4,085,000

Operation and maintenance—	
Navigation works.....	935,000
Power works.....	1,432,000
Depreciation—	
Power house machinery.....	742,000
Other works.....	1,432,000
Total	<u>\$26,653,000</u>

C. Annual Benefits of St. Lawrence Project in addition to those from Welland Ship Canal.

Power—Firm power—1,900,000 h.p. @ \$15.00	\$28,500,000
Additional summer power—300,000 h.p. @ \$7.50.....	2,250,000
Savings in transportation costs—	
Canadian Traffic. See report of March 1st, 1928, para. 58..	15,000,000
United States' Traffic. See report of March 1st, 1928, part	
“B,” par. 28—16,400,000 tons @ \$1.35	22,200,000
Total benefits	<u>\$67,950,000</u>

WELLAND SHIP CANAL

D. Annual Charges.

Interest on 1st cost—5 per cent on \$115,000,000	\$ 5,750,000
Interest on interest during construction—5 per cent on \$25,000,000	1,250,000
Operation and maintenance—1,000,000—600,000	400,000
Total annual charges—W.S.C.	<u>\$ 7,400,000</u>

<i>E. Saving in Transportation Costs by Welland alone</i>	<u>\$ 1,000,000</u>
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ST. LAWRENCE WATERWAYS PROJECT

TABLE SHOWING ANNUAL CHARGES AND BENEFITS FROM NAVIGATION WORKS ONLY

A. Overall Cost.

Section	First Cost	Interest during Construction Period	
Thousand Isd.....	\$ 1,100,000	\$ 55,000	
International Rapids Navigation			
Works only	34,350,000	4,465,000	
Lake St. Francis	980,000	25,000	
Soulanges	33,640,000	2,555,000	
Lachine	53,000,000	6,890,000	
Total	<u>\$123,070,000</u>	<u>\$13,990,000</u>	<u>\$137,060,000</u>

B. Annual Charges St. Lawrence Project.

Interest on 1st cost—5 per cent on \$123,070,000	\$ 6,154,000
Interest on interest during construction—5 per cent on \$13,990,000	700,000
Operation and maintenance	935,000
Depreciation	615,000
Total	<u>\$ 8,404,000</u>

C. Annual Benefits—St. Lawrence Project.

Savings in transportation costs—	
Canadian Traffic—See Report of March 1st, 1928 par. 58..	15,000,000
United States' Traffic—See Report of March 1st, 1928, Part	
“B,” par. 28—16,400,000 tons @ \$1.35	22,200,000
Total benefits	<u>\$37,200,000</u>

WELLAND SHIP CANAL

D. Annual Charges.

Interest on 1st cost—5 per cent on \$115,000,000	\$ 5,750,000
Interest on interest during construction—5 per cent on \$25,000,000	1,250,000
Operation and maintenance—1,000,000—6,000,000.....	400,000
Total annual charges—W.S.C.	<u>\$ 7,400,000</u>

<i>E. Saving in Transportation Costs—Welland alone</i>	<u>\$ 1,000,000</u>
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The first statement is based on the idea of taking power in the International Rapids Section as part of the project and avoiding contact with power developments in the National Section. With this set up the cost would be \$26,653,000, plus \$7,400,000, and the benefits that both countries and everybody else would receive would be \$67,950,000, plus \$1,000,000.

That is one set-up. The bases for all these figures are covered in a memorandum which I shall file with the Chairman.

The second statement is based on the idea that navigation will follow power development and only be charged with works built for navigation alone. It is based on the idea that some power interest will pay for common and power works. These would embrace the dam across the river and the general enlargement of the river and the power-house and machinery for both countries on both sides of the river. Now, that conception arises from a thought I get from reading the decisions of the Supreme Court and the Privy Council in connection with a lot of water power cases which have been tried in Canada and elsewhere, and also from the way in which the power has been leased on the Trent, where the Government made a river improvement of this type. Navigation is like the King's highway; the local authority must provide the land required without tax. Supposing the riparian rights were in private hands, the King would have the right to put in locks for passing from one basin to the other without asking the people who created these basins yes or no, or without paying any taxes for the use of those works. It is with the conception that if the river were improved for power, certain expenditures would have to be made, and those would logically include dams and channel enlargements as well as power works and the additional cost of dressing up the river for navigation would be the cost of putting in the canals for passing dams along with lift bridges and such like. In figuring out the first cost of the purely navigation works between Lake Ontario and Montreal, I assume the inland route for navigation in the Soulanges section. The reason that I take that way is this. As you know, the Soulanges section is somewhat complicated. We can build a canal there for purely navigation purposes for about \$35,000,000. If the river is improved as we recommend it should be, and we lock in and out of the pools, we have to spend \$32,000,000 for purely navigation works, locks, etc. If, on the other hand, a power company will build a canal 600 feet wide from Hungry Bay to Melocheville, we could provide works for navigation in and out of that canal for about \$20,000,000. The Federal Government might not have the right to do it, but in any case it does not look as though there is any reason for putting any more than \$33,600,000 into navigation works in this section unless some revenue from power is to be gotten. That makes a total first cost for locks and channels for navigation alone of \$123,000,000; this with interest during construction, \$14,000,000; totals \$137,000,000. At ordinary interest rates, and putting in operation and maintenance, and applying depreciation at half of one per cent on the permanent works, you get \$8,404,000 a year of annual charges on the St. Lawrence.

Hon. Mr. LYNCH-STAUTON: Between where and where?

Mr. McLACHLAN: Assuming the Welland canal is already built. Then the benefits from improved transportation would be \$15,000,000 for Canadian traffic and \$22,200,000 for American traffic, or a total of \$37,200,000.

Hon. Mr. DANDURAND: On what do you base those figures?

Mr. McLACHLAN: Before going into a justification of the balance sheet shown in the first statement, I would like to show you something about the power business. There are other people in Ottawa whom you can call who are greater authorities than I am, and who will have power figures in a better shape to show you than I have, but, still, I would like to show you some information on that subject.

Hon. Mr. BEIQUÉ: I do not understand yet what the \$442,000,000 covers.

Mr. McLACHLAN: It covers all the cost of all the work required, Lake Ontario to Montreal, including 2,200,000 horse-power in the International Rapids Section.

Hon. Mr. BEIQUE: But no power houses?

Mr. McLACHLAN: Oh, yes, including power houses and power machinery, and including interest during construction and interest during marketing period. It does not include anything for upper lake channels because they will be deepened in any case for lake navigation.

Hon. Mr. LYNCH-STAUNTON: The whole set-up ready to operate the power, and the canal?

Mr. McLACHLAN: Yes, ready to deliver power.

I think the cost of the whole project is covered except loss of value in elevators on Georgian Bay and losses in value of small canal boats. Something should be added annually to cover interest on these.

I wish to show you a few charts before we take up the cost of the operation of ships. As you know, in the last ten years the growth in the use of power in Canada, the United States, and many other countries, has been tremendously rapid. The Electrical World publishes a diagram every month showing the total kilowatt hours generated in the United States. This diagram shows a steady increase in the amount of power used each year. It also shows that the market is very far from the saturation point, in fact the rate of increase is still going up. The rate of increase is about 8 per cent per year or about 1,500,000 horse-power per year. The increase in use of power seems to be independent of good and hard times to a large extent at least. This matter of the growth in use of power has been occupying the minds of scientific men in the United States, and Canada, for some years. Some people wonder how long it is going to keep up. Colonel Kelly, who was Chief Engineer of the Federal Power Commission of the United States, was a member of our Board, and he provided me with a few diagrams that I would like to show you in connection with that matter. All curves associated with the use of any commodity such as coal, transportation, power, telephones, automobiles, are supposed to be of the same kind and the saturation point can be found if a small part of the curve of growth is examined.

Mr. McLachlan exhibited diagrams showing growth in use of power in various parts of the United States.

Hon. Mr. DANDURAND: What you want to show is that this is an infant industry.

Mr. McLACHLAN: Yes.

A diagram showing the kilowatt hours generated per year in Canada, and in Ontario and Quebec is presented. It shows a generation of 20,000,000 kilowatt hours per day in 1923; and 40,000,000 in 1927. For Ontario and Quebec they show 17,000,000 in 1923, and 34,000,000 in 1927.

Hon. Mr. LYNCH-STAUNTON: Is that reliable? As a matter of fact, if five years ago you had the same supply, would you not have had the same demand? Does not that curve just show the supply?

Mr. McLACHLAN: No. The curve is not to show the development that has taken place, but the amount that has been marketed; not what was available, but what was bought and paid for.

Hon. Mr. LYNCH-STAUNTON: I understand that the scheme of these curves is to show an increasing demand.

Mr. McLACHLAN: A demand that we can depend on.

Hon. Mr. LYNCH-STAUNTON: That is not my point. Was not the demand there before if the supply had been there? There is quite a difference between an increasing demand and the supply going up to the present demand.

Mr. McLACHLAN: This is designed to show what the industry must take care of from time to time.

Hon. Mr. LYNCH-STAUNTON: You do not understand what I mean. If the Americans had had five years ago a supply of power as large as it is to-day, would they have been using five years ago the same quantity of power that they use to-day?

Mr. McLACHLAN: No.

Hon. Mr. LYNCH-STAUNTON: Why would they not?

Mr. McLACHLAN: The theory is that the growth in use of power in recent years has been due to washing machines—

Hon. Mr. LYNCH-STAUNTON: Washing machines!

Mr. McLACHLAN: —and electric heaters, stoves—all kinds of domestic appliances. And of course these depend upon the annual purchasing power of the people, more than upon anything else. So it is understood.

Hon. Mr. LYNCH-STAUNTON: When we have hard times, down it will go again, eh?

Mr. McLACHLAN: I think it is quite likely the rate will go down, but as to the machines that are installed up to that time, the use of them, of course, will not stop. It would take an extra installation of 350,000 h.p. each year to supply the demand in Ontario and Quebec in recent years.

I want to show you that the market for power is like the opening up of a new world. The growth in use of power on the Shawinigan system is 60,000 h.p. per year excluding the shaded part which is the degraded use of power for steam for paper which does not count. The black line is the one you should think about.

Hon. Mr. LYNCH-STAUNTON: Have they got all the washing machines they are going to get?

Mr. McLACHLAN: You can see if there is anything in the studies of scientific men, we are at the bottom of this development and there is no indication of it turning down, for a long time yet.

The CHAIRMAN: I suppose this is as good a time as any to stop.

Mr. McLACHLAN: One second, and I will show you the Niagara system of the Hydro of Ontario. It shows a steady growth which it would take about 70,000 h.p. of new power to supply each year. There is a sure market for 75,000 h.p. per year in Quebec, and 75,000 h.p. in Ontario which can come from the St. Lawrence as well or better than any other place.

Hon. Mr. LYNCH-STAUNTON: But what you are coming at is that there is an ever expanding demand for power

Mr. McLACHLAN: What I am coming at is this, that the improvement of the power resources of the St. Lawrence is inevitable. You have got to meet it, and you have got to meet it before very long. Whether or not you build the navigation works is a matter for Governments to decide, but the improvement of the St. Lawrence River for power is something that cannot be long delayed.

Hon. Mr. LYNCH-STAUNTON: Have you read the article in the Gazette this morning?

Mr. McLACHLAN: No, sir.

Hon. Mr. LYNCH-STAUNTON: Well, there is an article on it there.

The Committee then adjourned to meet at the call of the chairman.

MINUTES OF EVIDENCE

EVENING SESSION

THURSDAY, 10th May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, etc., met this day at 8.30 o'clock p.m.

The Honourable C. E. Tanner presiding.

Mr. D. W. McLACHLAN, Engineer in charge, St. Lawrence Waterways, Department of Railways and Canals, Ottawa, Ontario, was recalled.

Hon. Mr. BEIQUE: Last night I read the important notes of Mr. McLachlan, and I realized how difficult it will be to understand this matter properly, although Mr. McLachlan has been very clear. But we must bear in mind that the public are not familiar with the locations, and with that in view I would suggest and I would move that Mr. McLachlan be asked to prepare the following:—

1. A sketch showing the International line throughout the international boundary waters and the crossing of the navigation channel, with distances covered by each section on one side or the other of the international line, and giving the names of the main places. This would be a sketch which can be tied up with the evidence.

2. A memorandum stating and enumerating the nature of the works made for the purpose of improving navigation in Canada or the United States, and the approximate cost thereof.

3. A memorandum showing the advantages or disadvantages of maintaining the navigation channel in its present location in the project of development of the St. Lawrence river, or, the possibility and practicability of the navigation channel being all on the Canadian side, and the approximate amount of expense involved therefor.

In this country the people I have met have expressed the desire that the navigation channel be all on the Canadian side; so we should see whether it is possible and practicable to have it so, and we should know what would be the expense of it.

Mr. McLACHLAN: I would like to ask a question. Senator Reid has asked that the canals where there is a lock should be on the Canadian side. Now, is that what is intended, or is it intended that a ship shall stay always on the Canadian side?

Hon. Mr. REID: No. I want to put myself right. What I was asking was this: To have navigation on the Canadian side merely where an obstruction would come along, such as a lock. Coming down from Port Arthur a ship goes back and forth on one side and the other.

Mr. McLACHLAN: Do you mean by that, to put the channel on the Canadian side between Gananoque and Brockville, Senator Beique, north of Wells Island, or south of it?

Hon. Mr. BEIQUE: I have heard the opinion expressed by several people that it should be all on the Canadian side. Of course, they were talking of from Prescott to St. Regis. That is what they had in mind, but I put it generally because I think there would be a preference in the mind of certain people to have it all on the Canadian side.

Mr. McLACHLAN: Even at the Thousand Islands?

Hon. Mr. BEIQUE: Even at the Thousand Islands, I think.

Mr. McLACHLAN: On which are we to make the estimate?

Hon. Mr. BEIQUE: If you have no data you will say so.

Hon. Mr. BEAUBIEN: You mean the canal, not the channel?

Hon. Mr. BEIQUE: The navigation channel whether it be a canal or not.

Hon. Mr. REID: Well, I would like that thoroughly understood, because it would be such a ridiculous proposition to say that from Port Arthur to Montreal we must have everything on the Canadian side.

Hon. Mr. BEIQUE: This is the view taken by people who do not know. I have met people who are not informed at all, but they have read the requests in the papers, and they are expressing an opinion as if they knew, and they think it should all be on the Canadian side; so, I have added "channel or canal."

Hon. Mr. REID: I would like to make an amendment to that.

Hon. Mr. BEIQUE: I thought you were advocating this?

Hon. Mr. REID: I never advocated what you mention. You are going to suggest something and say that is what I advocated. I never spoke about anything except from Prescott down to Cornwall.

Hon. Mr. BEIQUE: I am not advocating anything. I am merely asking a question.

The CHAIRMAN: Senator Reid's objection could be met by leaving out the word "all."

Hon. Mr. MURPHY: Possibly what Senator Beique means is to take the report of the joint board of engineers. Senator Beique desires to know how much that would cost if all the projected work in that report were on the Canadian side; is not that the idea?

Hon. Mr. REID: I will just tell you what I don't want to happen. If Mr. McLachlan understands that from Port Arthur to Montreal we must have everything on the Canadian side, locks and so on, he will bring down a statement showing a cost three times or five times as much; then people would say, "Here is what Mr. McLachlan says—it will cost a billion dollars for this work, and it can be done for so much."

Hon. Mr. LYNCH-STANTON: I think that would be confusing.

Hon. Mr. BEIQUE: Merely say this: it should be mentioned by sections, and the cost should be by sections. If your mind is made up, I have no objection to limiting it.

Hon. Mr. REID: I will tell you what I would like to limit it to if you want to consider it—Lake Ontario.

Hon. Mr. BEIQUE: I have no objection.

Hon. Mr. REID: Supposing we take it from Lake Ontario. There is only that portion between Lockport and Brockville that would be approached which would possibly not be as good a channel. There is only that piece, I think, from Kingston to Prescott.

Mr. McLACHLAN: There is a piece from Howe Island to Lockport where, if you put it on the Canadian side, it would cost us ten million dollars more than if you put it on the American side—one million dollars to put it on the American side and eleven or twelve million dollars to put it on the Canadian side.

Hon. Mr. REID: Interpret Senator Beique's motion to say: show us the section between Lake Ontario and Prescott; what it is going to cost on the American side; and then show us what that will cost on the Canadian side. That would show the cost there separate. That is the river. There are no canals at all. Then from Prescott down to Lake St. Francis show us what it would cost to give us the channel from Prescott on the Canadian side, only where you would have to go around the rapids—anyway show it on the Canadian side, and then on the American side.

Hon. Mr. BEIQUE: I suggest that the Chairman and Dr. Reid consult with Mr. McLachlan and direct him as to what is required.

(Suggestion agreed to and carried.)

Mr. McLACHLAN: Mr. Chairman, I cannot hope to make this discussion of economics interesting. I know it is such a dry subject that I know I cannot make it interesting. I prepared, since the last day, about thirty copies of a tabular statement which I discussed the other day, and I will pass these around. These are a set of tables showing two set-ups of the St. Lawrence Deep Waterway Project. In one you will see the interest on the cost, the operating charges, and all those things that go to represent cost; and in the other, in statement "C", you see the benefits that somebody will receive. You will notice that one is about two and half times the other. The first statement—that of cost—you can check up by reference to the deep waterways report, and I think you will find it is quite in accord with the figures given there. The benefits to be derived from waterway improvements are very very debatable. I will run over what I have prepared in a certain way.

The CHAIRMAN: From a navigation point of view?

Mr. McLACHLAN: From a navigation point of view and then from a traffic point of view.

A couple of months ago my staff prepared a memorandum, one copy of which I am proposing to give to the chairman to do what he likes with. It contains an enormous amount of statistical information with regard to traffic by various routes in various places, and also an enormous amount of information about shipping and cost of shipping and cost of ship construction, and that type of matter. Now, I will run over the notes I have made, and refer occasionally to two documents, both of which I will file.

Now, the first item you will notice is power—1,900,000 horse-power,—which is power capable of being delivered at peak hours of each day the year round. It is put in at \$15 a horse-power.

Hon. Mr. DANDURAND: That is in the International Rapids Section?

Mr. McLACHLAN: That is in the International Rapids Section. That is exactly the price that the Ontario Hydro-Electric Power Company pay to the Gatineau Power Company for delivery at the provincial boundary. It is taken at that price both on the Canadian and the American side. I know we should always get it at a lower rate than that on the Canadian side. On the American side they can afford to pay a higher figure than \$15 per horse-power.

Now, the power that is available for eight months but cannot be delivered in winter on account of reduced heads due to ice, I put down at half price.

The next item is savings in transportation costs. As you see we have estimated the traffic at sixteen millions for the United States and eight millions for Canada. We did make quite a careful study of the American traffic avail-

able for this waterway some years ago. We found about 12,000,000 tons of profitable traffic. In this document we thought it best to summarize the findings of the United States Department of Commerce which dealt with the subject quite elaborately in a report published in 1925. They estimated their traffic at 16,400,000 tons. Of this amount 8,600,000 tons was export, 2,960,000 tons was import, and 7,000,000 tons was coast-wise. They show in that report a minimum and a maximum tonnage for each of these classes of business. I have given you the minimum. The United States engineers who reported about a year earlier on a deep waterway by Lake Ontario and across by Oswego to Albany estimated their traffic at 15,500,000 tons. I found 12,000,000 tons of American traffic in 1923. I could not, from statistical returns, trace anything that could be handled profitably beyond that figure. If I went at it again I might find more potential traffic than in 1923.

I will just run over Canadian traffic statistics for the year 1926. The tonnage passing the Soo, as you know, is about 85,000,000. The distribution of this tonnage as to the various classes of traffic is given in the United States Soo Canal report issued every year, in Table 17. You can see what is ore, what is coal, what is grain, what is package freight, what is up, what is down, and so forth. The Welland canal last year had a traffic of seven and a quarter million tons and the St. Lawrence had a traffic of 7,900,000 tons. The St. Lawrence canals had a larger traffic than the Welland canal due to coal moving from Lake Ontario ports to Ogdensburg and Montreal and also due to pulpwood moving from the lower St. Lawrence to Waddington and Ogdensburg.

The grain shipped on the Great Lakes for the fiscal year, 1926, was 430,000,000 bushels. Of that amount 295,000,000 bushels left Fort William and Port Arthur, 25,000,000 bushels left Duluth, 50,000,000 left Chicago and 9,000,000 left Milwaukee. In that year 93,000,000 bushels went through our own elevator at the head of the Welland canal, at Port Colborne and 135,000,000 bushels went through Montreal.

Hon. Mr. McLENNAN: Have you trans-shipments direct?

Mr. McLACHLAN: It was all trans-shipped at Port Colborne.

Now, if you want to look at the figures for other years, you can find them in the documents I leave with your chairman.

It may be of interest to look at exports for the whole of Canada and the whole of the United States in the way of grain. In 1926 Canadian exports were 347 million and the United States exports were 274 million. They are given for other years in Table 44, page 336. Now, a great deal of that goes out by the gulf ports and a great deal goes out by the Pacific ports, some goes out through our own port of Vancouver; so a great part of that is not tributary to a waterway from the Great Lakes. The exports from Montreal, Quebec, Halifax, St. John and United States North Atlantic ports clear down to Baltimore were 298 million of which the Canadian ports handled 209 million and the American ports handled 89 million in 1926. A lot of the grain goes out in the five months of winter as Europe requires grain more or less continuously in winter, and a considerable part of that five months export will not be of interest to the waterway unless Europe stores grain. In the future it may be moved past Buffalo to some Canadian port and gradually moved during the winter to Atlantic ports and then shipped on to Europe as now. In the seven month of open navigation the amount that left Canadian North Atlantic ports was 131 million bushels and from United States North Atlantic ports 68 million, showing a great dropping down of the total volume with which we started. It also shows how well we are doing in the port of Montreal.

Another factor I would like to mention is this: all summer the ore fleet moves ore from the Messabi ore ranges to Lake Erie ports; the movement

amounts to about 10 million tons a month. When the month of November comes the ore shipments drop down to 3 million. That is shown in this appendix, table 45, page 336, for every month of every year for about ten years.

Hon. Mr. DANDURAND: Do they all return empty during the summer months?

Mr. McLACHLAN: Generally speaking, yes. Occasionally they take a load of coal back from Buffalo up to the head of the lakes, but, generally, two-thirds of them go back empty.

Now, what happens is this. In the month of November the boats that have been in the ore trade up to that time go to the head of the lakes and haul grain across to our Georgian Bay ports, down to Port Colborne and to Buffalo, and any place where they can get rid of that grain. There is so much carrying capacity thrown into the grain trade, that they always clean out Fort William and Port Arthur by the end of the navigation season, say the 10th, of December. Apparently, if there were more grain to move than there is in the months of November and December, there would be enough capacity to do it, because it is not all taken up, and the idle tonnage in November and December is not all used, that is, the idle ore tonnage.

Hon. Mr. DANDURAND: Do you mean Canadian?

Mr. McLACHLAN: The ore tonnage is nearly all American.

Hon. Mr. McLENNAN: Do those boats still act as storage during the winter?

Mr. McLACHLAN: Yes. More than that, when the elevators get filled up in November the boats, of course, load up and if possible lie in some eastern port as winter storage. Buffalo is not a good berth for ships, but it is well placed so far as the Atlantic shipments in winter are concerned and boats still like to stay there. Forty million bushels of grain is in storage in boats about the middle of December in Buffalo some years. In other years it is less. If we provide good winter quarters at Gananoque or Prescott we may get that trade.

Hon. Mr. BELCOURT: Of all the grain exported from west of Winnipeg, how much of it is shipped through American ports and how much is shipped through Canadian ports?

Mr. McLACHLAN: All our grain—the bulk of our grain goes out through the American ports, but the bulk of the United States grain goes out through our ports. They reverse each other, as you know. The reason for that is that our grain ripens late and comes down in volume in October and November, and naturally the owner wants to market it during the winter as much as he can so he routes it to Buffalo in preference.

Hon. Mr. BELCOURT: What are the figures?

Mr. McLACHLAN: I can give you the figures. What figures did you ask me for?

Hon. Mr. BELCOURT: What proportion of the grain which is exported—grain originating west of Winnipeg, and I am speaking of Canadian grain—how much of that grain goes through Canadian ports and how much goes through American ports?

Mr. McLACHLAN: In the figures I gave you I did not distinguish between American and Canadian grain. I did distinguish between American and Canadian ports.

Hon. Mr. BELCOURT: Perhaps you can tell us later on. Will you give us the same figures with regard to American grain?

Mr. McLACHLAN: Yes. I can give you all these figures. They are all in these statistics I have given you, but in running over them I did not sort them out that way, but by ports.

Hon. Mr. BELCOURT: I would like to get it that way, because it seems to me that is the best way to explain the situation.

Mr. McLACHLAN: No. I don't think it has much bearing on the thing, because what happens is this: In midsummer the American grain ripens away to the west of Chicago. That is delivered to Lake Michigan. The remainder of our previous year's crop is petering out and the new crop has not come in. So, our boats more particularly because their boats are busy with the ore, are looking for business, and, no Canadian business being available, they turn to the American business, and they haul American grain from Chicago around to Port Colborne or to the Georgian Bay ports, and that has a tendency to turn American grain from American channels, and to fill up in the sag in mid-summer in our business, at Montreal and Quebec.

In May to November, inclusive, in 1926, as shown in table 23, page 325, 48 million bushels of Canadian grain went out via United States Atlantic ports, and 83 million by Canadian Atlantic ports. In that same period 27 million of United States grain went out by United States Atlantic ports and 33 million by Canadian ports. The statistics of other years are given in tables 23 and 23a, pages 325 and 326.

Hon. Mr. REID: And freight rates are very much lower?

Mr. McLACHLAN: Yes. In the fall of the year, however, the reverse is the case. American shipping is available because the ore is frozen up. Our ships, of course, are busy too, but as the volume swells the American boats pull into our trade and haul from Fort William to Buffalo, because the exporter as a rule wants to get his grain in the most advantageous place for winter shipment. That refers to our grain. The American exporter of grain is not worried about getting his grain in an advantageous place for winter shipments because his grain is on the market so early that it can go across the Atlantic before winter comes.

Hon. Mr. DANDURAND: So that our storage that our grain people have put up at Buffalo is for the handling of grain to be exported through American Atlantic ports?

Mr. McLACHLAN: Surely. And the elevator that the Chicago people have put up at Port McNicholl, the Aberdeen elevator—they were put up by Chicago people.

Hon. Mr. BEAUBIEN: Do I understand that the American grain exporters have a greater interest in cheap transportation and that is why early in the summer they take the Canadian route, and that the Canadian grain, late in the summer is pressed for time, and, therefore, it is sent to Buffalo?

Mr. McLACHLAN: That is it.

Hon. Mr. ROBERTSON: What is the information as to the increase or decrease in the volume of American grain shipped for export? The increase in home consumption is interfering with the volume for export. Is there any indication whether the American grain traffic is likely to increase very much?

Hon. Mr. BELCOURT: What is the quantity of service inuring to the Americans, and what is the quantity of service inuring to the Canadians through our canals?

Mr. McLACHLAN: Well, I don't know how I can answer that. It is a very complicated service.

Hon. Mr. DANDURAND: Could not these questions that are a little involved be put to Mr. McLachlan at the end of his statement so that he may prepare his answers to them for our next sitting?

Hon. Mr. BELCOURT: I quite agree with that.

Mr. McLACHLAN: The origin of trade is generally thought to be the important thing. American coal originating on Lake Erie and going to Montreal we consider American traffic. I don't know whether you would consider

it a service to the American people or not; we are the buyers and they are the sellers. As far as pulpwood is concerned, the same thing is true.

The production of wheat in Canada is shown in table 26, page 328. It shows, in 1925, a production of wheat in Canada of 411 million, and export of 222 million. It shows a production in the United States of 676 million and export of 86 million bushels. The production of all grain in 1925, in the United States, was 5,343,000,000 and in Canada 1,061,000,000 bushels. Exports of grain and flour equated to grain are shown in table 44, page 336, at 275,000,000 bushels for United States and 347,000,000 for Canada. If you look over these tables you will see that Canadian exports and production of both wheat flour and all grain have been continuously increasing, and the exports of United States grain have been falling, but flour has been increasing. In general the total of wheat, other grain and flour is the same now as it was thirty years ago so far as United States product are concerned. The exports of wheat from the United States in 1925 were less than 86 million bushels, but they are up again in 1926 and 1927.

Hon. Mr. HUGHES: Did the production increase at the same time?

Mr. McLACHLAN: The production was largest in 1914-15, I would say, looking back. I do not think the production of wheat has changed in twenty years, with the possible exception of that one year. It seems strange that out of a total export of the equivalent of 347,000,000 bushels or 9,000,000 tons we should figure only 4,450,000 tons as available for our deep waterway. Perhaps we are too conservative, in any case we are safe.

Now, to figure benefits from a waterway, we have a number of ways of going about it. Most people deal with rates. Take rates over a number of years and compare the time it takes a boat to travel the length of the new route and compare that with the time it took on the route that they had, and in that way they make a determination as to what the rate would be in the future. That is not the way this document I am filing with you was prepared. In a minute I will tell you how it was prepared, but just before doing so I will give you a little outline of what you can adduce from rates.

The rate per bushel for the last five years from Fort William to Buffalo was $3\frac{1}{2}$ cents per bushel; from Port Colborne to Montreal it was $6-5/100$ cents per bushel. In those rates .7 cents was absorbed for terminal elevator charges in the movement from Fort William to Port Colborne, and 1.44 cents in the movement from Port Colborne to Montreal. Those are labour charges and charges the elevator made on the boat, and they are contained in that rate. Now, if you analyse these rates and allow for the retardation of a boat going through the Soo locks and other things of that nature—that is if you take and determine on the basis of time how much that cost is of actual movement per mile across a lake surface by a great lakes boat you will find that it works out at 8 cents for every ton hauled one hundred miles, and it works out at about 24 cents per ton for the terminal delays occasioned to that boat. Now, if you take the canal boat and do the same, you will get a rate of about 16 cents for the clear parts of the journey. Naturally the retardation of the Welland canal locks and the restricted channels on the Welland, along with the retardation of the St. Lawrence locks and the restricted canal channels along the St. Lawrence has virtually doubled the distance between Port Colborne and Montreal. A boat could travel twice the actual distance between Port Colborne and Montreal in the same time if the journey were all lake.

The distance between all ports on the route is given in table 1, page 314. If you analyze railway rates you will find that the railway rate from Buffalo to New York would work out at 58 cents for a ton hauled one hundred miles, and the cost of delays charged to terminals, yard delays, et cetera, would be about 40 cents per ton.

Now, that 8 cents on the great lakes is an interesting figure because if you take ocean rates from ports all over the world you will find that that 8 cents per hundred ton mile practically fits every grain route of the world. I have for three years tabulated the rates published in the International Institute of Agriculture—a bulletin which is circulated in Canada every month—and I find that the rate from Australia to Liverpool, the Argentine to Liverpool, Karachi to Liverpool and Vancouver to Liverpool and many others would work out at about 8 cents per hundred ton miles. I haven't made any attempt to enter up records in recent years, I some times glance at them to see they have not changed.

Now, in the memorandum that we have prepared we approached the determination of the saving per ton by quite a different method from working with rates. What I did in 1922 and 1923 was to write a great many letters to ship builders in different parts of the world, and I got from them a specific price for duplicating a specific ship which I identified as a ship that was suitable for a channel of a given depth, and in this document I will file with you you will find letters from ship builders covering three or four ships that were being built at that time in Great lakes yards, three or four canallers that were being built in the old country yards, three or four ocean going ships that were being built at that time in British yards. In that way I determined the cost of ships per ton of dead weight carrying capacity. Then I interviewed a great many ship operators and owners to determine the number of the crew that is required for each ship and got the coal consumption in their trials; and in that way I set up a table which would show the operating cost of the different kinds of ships which we have to consider in determining whether a deep waterway would be of any use to us or not.

Now, that involves a lot of quite complicated calculations, but I think if you will take the time to look them over you will have more confidence in them than you would have in anything that I or anybody else could say based on rates; because, for every different voyage that you are considering you determine the coal consumption between two points; you determine the bunkering you must carry; the supply of fresh water she must carry; then you get down to the determination of how much freight she can carry, and, having your operating costs determined, you can determine what your rates should be.

Now, that, of course, is all based on continuous operation for seven months of the year in the great lakes and based on eleven months operation on the ocean, because you always have to allow a month to lay up.

The results of the inquiries of ship owners and operators are shown in table 2, page 314. The time of travel is shown with every different route being considered in the succeeding tables. The rates derived from all these calculations are shown on page 302. They show the cost of transportation of a ton of freight from Fort William to Liverpool by the present route at \$5.87 a ton, and by the deep waterways, if it was built, at \$3.95, if there was no transfer—if there was a direct shipment from Fort William to Liverpool.

By Hon. Mr. Reid:

Q. Explain that again; I am afraid I do not understand it.—A. These costs, and all the calculations show the cost of moving a ton of freight from Fort William to Liverpool to be \$5.87, by the present route.

By Hon. Mr. Dandurand:

Q. Breaking bulk?—A. Yes, breaking bulk at Port Colborne and Montreal. If you did not have to break bulk at all you could bring that down to \$3.95, which shows a saving of about \$1.90 per ton.

By Hon. Mr. Laird:

Q. Do those figures include the profit to the ship owner?—A. Yes, they include interest, depreciation, and other things. 14 per cent is quite the usual thing to allow for those things.

Q. And insurance?—A. Yes, insurance. I might add at this point that we made a careful inquiry into insurance rates in these routes from insurance people, and varying insurance rates were used, according to the usage at that time. Since that date insurance rates have changed, materially, and these figures have been corrected for that. That is, insurance rates on the ocean have gone down in the last five years, and insurance rates on our canals have gone up, very greatly. The insurance rates on the lakes have gone slightly down. There is quite a big change in the last five years in insurance rates.

If this deep waterway were built there would be a lot of grain hauled down in the months of November and December, and stored at some lower lake port—Prescott, presumably; that is the most likely place. That grain would be left there in the Fall of the year, and in the Spring of the year a great deal of it would still not be marketed, and an ocean boat would come up and get it. That would mean there will be one transfer. Some of that will also be carried through to Montreal in the Fall of the year, but not so much of it, because you cannot get to Montreal as late as you can to Prescott, on account of the temperature of the water. If you have one transfer the saving would only be \$1.30 instead of \$1.90. So we have to detail all that in setting up the savings.

By Hon. Mr. Lynch-Staunton:

Q. \$1.82, did you say?—A. No, I said \$1.30, instead of \$1.90. So that we, in setting up the savings in transportation have taken the average of these two figures as being the most reasonable figure to take. The thing is all worked out for the different seasons of the year, because the rates change, and it is set up for May 1st to September 31st, and then from October 1st to October 31st, and November 1st to November 25th, because it is not quite the same in all seasons.

By Hon. Mr. Hughes:

Q. Was that calculation made on the supposition that the ocean boat would go as far as Fort William?—A. Yes. I calculated that the ocean boat would go to Fort William. Half a dozen years ago I took a trip to the Old Country, and I spent a few days on the Manchester Canal. I got on board boats and went up and down the canal to see the difficulties of the ocean boats passing through the locks. I did not come back with any feeling that there was anything to fear in that regard. A good deal of argument is sometimes advanced about the ocean carrier being a ship of great size and great depth, and that she will not come to any port that has not 40 feet of channel depth, and all that kind of thing. I searched the world for information on that subject, and the place that gave me the best information in that regard was the port of Rosario, in Argentina. There they have a depth of 25 feet that varies a little with the season—never more than $25\frac{1}{2}$ feet, and sometimes $23\frac{1}{2}$ feet. And I found that 50 per cent of the grain export of Argentina are shipped from the Port of Rosario. I also found the difference in rates between the Port of Rosario and the Port of Argentina was hardly possible to detect in the rates published by authoritative bodies, such as the International Institute of Agriculture, and other people like that. In this document we give the difference in rates between those two ports, and we also give the effect of a lock on rates, because you can get that from a comparison of the rates to Manchester and to Liverpool. The Manchester canal has five locks, it is 120 feet wide on the bottom and is 28 feet deep.

Q. Are lake boats larger carriers per ton?—A. Yes, I will come to that in a minute.

By Hon. Mr. Murphy:

Q. Just follow your statement, and answer the questions later.—A. We give in the early part of this memorandum a comparison between the St. Lawrence Deep Waterways and a number of other shipping lanes that are used extensively. The Manchester Canal, as a matter of fact, is very much narrower than our deep waterways. It is 120 feet, against 200 provided in our canal plans. The curvature entering a lot of the ports of Europe, particularly—

By Hon. Mr. Dandurand:

Q. Antwerp?—A. Quite right—Antwerp—the curvature on the Schelt is far sharper than anything we propose. The curvature on the Parana River, running up to Rosario is far greater than on the channels we propose to navigate. The result of the inquiries that we made from shipping people, when averaged up showed that a canal boat at that time cost \$79 per ton of dead weight carrying capacity. It showed that the ocean tramp cost \$56.50. The lake freighter cost \$62.50 per dead weight ton of carrying capacity. If you related that specifically to cargo the rate of the ocean tramp per ton would go up, compared with the lake carrier, because the bunker space is much greater. But in carrying a grain cargo the boat usually goes down to her Plimsoll marks before she is full.

As to the determination of the volume of traffic, Canadian Traffic, we have prepared a discussion of that matter which I think is much too long to read, but I might give you what the tables are, as we deduce them. We figured that originating in Canada and using this waterway there ought to be four million tons of grain. That is figured on the basis of the long ton—38 bushels of wheat to the ton.

By Hon. Mr. Lynch-Staunton:

Q. 38?—A. Yes.

Q. Are you taking 38 all the time?—A. Yes, we take long tons, always—2,240 pounds, because that is the ship ton. We figured there would be 450,000 tons of flour; 800,000 tons of B.C. timber going around through the Panama Canal and going up through the waterways for use in Canada—particularly in Ontario. That, of course, is based upon statistics furnished us by the B.C. timber trade—I forget the name of the association. We figure there will be 800,000 tons of Scotch and Welsh anthracite coal come in through the waterway and be distributed to Western Ontario. That is based upon statistics of recent years. Other commodities we have put down at 2,000,000 tons, making up 8,000,000 tons of traffic. On that we estimated savings as follows:—the grain was taken at \$1.50 a ton—an average of the two figures I gave you. The flour was figured at \$1,600,000; the coal at \$2,000,000 and other commodities at \$3,000,000, making up \$15,000,000 worth of benefits on goods originating in Canada.

By Hon. Mr. Reid:

Q. Is that taken from the railways?—A. We got after these things from the best statistical sources known, and very often from trade concerns. The Bureau of Statistics helped us a great deal in this. You would have to read the text to determine it. The amount determined in these various ways, of course, has to do in some cases with the out-of-pocket cost of railway transportation. Whenever we figure a waterway against a railway we do not figure the waterway rate against the railway rate, but we figure the waterway rate against what we call the out-of-pocket expenses of the railway, which of course would be about 40 cents per 100 ton miles, rather than a rate like 58 that would give them some profit, or provide superintendence which they have to do in any case for other traffic.

I also give in this memorandum a lot of tabular information showing the character of the ships that are afloat on the ocean and those that are being built from year to year. I am sure if you will examine it it will show you that a waterway to be successful should provide a depth of about 27 feet below the coaling ports, when you deal with ocean boats you will find that the number of ocean boats which draw less than 24 feet are becoming less and less which means not many below this draft are being built. Boats of 25 and 26 feet draft are still used in greater numbers than any other size. I do not think it would be wise to build this waterway below lake Erie for 25 feet, because if you did that you would have to assume that you are going to affect the size of the ocean boat. The average draft of the carriers of the world to-day is only about 24.7 feet. That is salt water draft. It is deepening, very, very slowly,—perhaps a half a foot in ten years. The passenger boat, on the other hand, has been growing very, very rapidly. The average draft of the passenger ships afloat is, I suppose, increasing three or four feet every ten years.

The question of whether that 27-foot depth should be extended through to Lake Superior is another matter. Undoubtedly the ocean boat coming into the country will figure on coaling in Lake Ontario or Lake Erie, because of the accessibility of the coal fields to the south, it would for the short voyage up to the head of the lakes never require to take much coal, and consequently would not need to load to its maximum draft. It could easily enough come down from Fort William with its full cargo and not draw within a foot, at least, of its maximum draft. But when it took on its supply of coal, and its fresh water, it would go down to its full maximum draft of 25 feet. The American engineers, in their dealings with me—

By Hon. Mr. Lynch-Staunton:

Q. I cannot hear you?—A. The American Engineers are absolutely set on the idea that they do not need to deepen the channels above Lake Erie to more than 25 feet, because from their statistical information, and from their personal knowledge dealing with ports on the Gulf of Mexico, and other isolated places around the United States, they are convinced that 25 feet is ample to admit the kind of ocean boat that is wanted in the Great Lakes, because the ocean boat that is wanted in the Great Lakes is one that will sail from there to Liverpool, 4,400 miles, or 3,200 from Montreal. That is a short voyage, as ocean voyages go, because the voyages from Argentine to Liverpool and India to Liverpool are all 7,000-mile voyages.

From an analysis that naval architects have made it can be shown that for a voyage of that length the most economical boat is not a large boat. It is about 410 feet long, and it draws about 25 or 26 feet of water.

By Hon. Mr. McLennan:

Q. What dead weight?—A. 8,000 tons.

By Hon. Mr. Reid:

Q. When you speak of 25 feet, does that mean the draft of the boat?—A. That means about 23½ feet of draft. 27 means about 25½ feet draft. Some people differentiate between clay channels and rock channels.

Q. I just wanted to know what it was.—A. Yes, you need a foot and a half clearance, and most people figure on 2 feet, especially if there are any boulders about.

The estimating of American traffic is a very complicated matter. I do not know whether or not I should try to go into it with you, but I think that the best way to leave it is with the bald statement that their own investigators determined it to be about 16,000,000 tons. In the memorandum we give their estimates on page 311 and we give the complete details of how they made up their totals in table 38, page 333.

There is one other thing, just before I stop. You will notice I have a balance of \$26,000,000 for costs and \$68,000,000 for total revenue, assuming a federal agency develops power in the International section. There would still be some things that should be absorbed in the cost of this project. The canal carrier—the little canal 2,400-ton boat, as you know it—about 100 of them would no doubt have a very restricted use after this waterway is built, because all they would be used for would be for pulpwood and coal between Lake Ontario and Montreal part of the interest on their value should be deducted from the revenue, or added to the cost.

Also the elevators at Port McNichol, Goderich, Port Colborne and Midland—they would all suffer a reduction in value. They would in the future be used only for supplying domestic requirements, and I think you would have to absorb their cost in this project. As you go over the tabular statement you will see a few things like that that should be put in. I did not attempt to put them in, because I just wanted to put something down in black and white that could be talked about.

The benefits that the Americans receive from this waterway, namely 16,000,000 tons at \$1.35 per ton—\$22,000,000 is possibly a high estimate. I think it is possible their traffic will be less than that. I do not think their savings per ton will be less than that.

As regards the capacity of our present canals, someone asked about that. That was investigated very carefully by Mr. Henry and I in connection with the question of where the terminals should be placed at the foot of Lake Ontario on the completion of the Welland Canal. I have a memorandum I prepared at that time. I can give it to you.

MEMORANDUM Re TRAFFIC CAPACITY OF ST. LAWRENCE CANALS

Close observations of the operation of the St. Lawrence canals at Cornwall shows that the capacity at locks 15 and 17 is about 20 boats up and 20 boats down per day, if traffic each way is not unbalanced.

If boats present themselves with precise regularity each way, capacity may rise for a day to 20 boats at night and 26 during daylight hours, or a total of 23 each way per twenty-four hours. If all boats passed during a twenty-four day are down bound, maximum capacity is found to be about thirty per day. If all boats are up bound, maximum capacity is found to be about 44 per day. A practical capacity of 280 boats of average size per week may be assumed.

The relation between passages and capacity during busy weekly periods is shown in the following table:

Date to date inclusive	Actual Passages Lock 15	Estimated Practical Capacity	Estimated Full Theoret- ical Capacity	Percentage of practical capacity	Per cent of Theoretical Capacity
May 20 to May 26.....	256	280	322	91.5	79.5
June 3 to 9.....	254	280	322	90.7	79.0
June 12 to 18.....	252	280	322	90.0	78.2
Aug. 15 to 21.....	242	280	322	86.4	75.0
Sept. 13 to 19.....	248	280	322	88.6	77.0
Oct. 8 to 14.....	245	280	322	87.5	76.0

From this table it would appear a ten per cent increase in traffic can take place on the St. Lawrence Canals at Cornwall without serious congestion. In the Lachine and Soulanges Canals the practical weekly lockage capacity is about 72 boats per day or 504 per week. This is about 56 per cent greater than the capacity of the Cornwall Canal at Cornwall. The annual traffic capacity of the Cornwall Canal having regard to the way in which business presents itself may be taken at 9,000,000 tons. The capacity of the Soulanges and Lachine Canal may similarly be taken at 14,000,000 tons.

D. W. McLACHLAN.

The capacity of the St. Lawrence canals from Prescott down to Cornwall is very nearly reached in the months of October and May. The completion of the Welland Canal and the shifting of the terminal down to Prescott will congest the canals for the reason, that the length of the voyage of the boat will be reduced from about $6\frac{1}{2}$ days to 3 days or with terminal delays from $9\frac{1}{2}$ days to 6 days. So if the one hundred boats on the route were all busy and taxed the canal to within 10 per cent of its capacity there is sure to be congestion with the voyage for 84 per cent of the down bound business reduced from 9.5 days to 6.0 days per trip. In fact an increase of 75 per cent in lockage capacity would be required to keep the canal fleet busy after the point of transfer is shifted to Prescott.

By Hon. Mr. McLennan:

Q. Just speak a little louder.—A. I am sorry. The time of the voyage from Prescott to Montreal, on the completion of the Welland Ship Canal will be only about 3.0 days plus time in terminals 3.0 days total 6 days. The time of voyage from Port Colborne to Montreal, under the present conditions is about 6.5 days plus time in terminals 3 days total 9.5 days. You can see that the canal tonnage would carry about twice as much as they are now carrying. But that does not mean that there will be double the tonnage carried, because some of those canal boats are now in use hauling coal from Lake Ontario to Montreal. That would not be changed. Some are also used for hauling pulp wood from the lower St. Lawrence to the paper mills at Ogdensburg, Waddington, and Thorold. The grain trade makes up 84 per cent of the down bound traffic on the canals. The present fleet are capable of handling a 75 per cent increase in grain traffic to Montreal. If we had high-water years for the next half dozen years so that the boats could run the open river at Morrisburg instead of going through the lock, our canals at Cornwall, figuring on a weekly capacity, could handle about 15 per cent more traffic than they are handling. If we have low-water years like we have had in the past and the boats have to go through the lock at Morrisburg they cannot handle any more than they are handling now during about three months of the year. If we could get over, in some way, the navigation difficulties of the International section the Soulanges and Lachine canals could handle 60 per cent more than they can handle now.

By Hon. Mr. Reid:

Q. Is that remark confined to the rapids section?—A. Yes. That has sometimes caused me to think of an alternative to our deep waterways, and that is if we could temporarily eliminate the swift water from Prescott to Weavers Point we would then have slack water from there to Montreal.

By Hon. Mr. Lynch-Staunton:

Q. That is the neck of the bottle, there?—A. Yes, that is the neck of the bottle. Two things would happen if we could eliminate that swift water. We could use boats with less power and less bunker capacity, greater carrying

capacity, and smaller crew. But before a move like that would be any good we would have to duplicate the locks at Cornwall, because the two locks there would have to be duplicated; they have not sufficient capacity to care for anything more than about 15 per cent increase in traffic.

By Hon. Mr. Murphy:

Q. Do you mean the two existing locks, or the two proposed locks?—
A. The two existing locks. In low water years the capacity of the St. Lawrence Canals is determined by the Morrisburg canal. In high-water years it is determined by locks 15 and 17 at Cornwall. If you eliminate those two things you can increase the capacity 60 per cent. If you can eliminate the swift water between Prescott and Weavers Point you can improve greatly the type of boat you are using, because from Crysler Island or Weavers Point to the head of the Cornwall Canal you are in slack water.

By Hon. Mr. Graham:

Q. How could you eliminate that?—A. By building the Crysler Island project now, and doing nothing for six years. Perhaps you may do a little bit of excavation to enlarge the canal just below Crysler Island. Perhaps not.

Q. Weavers Point is between Crysler Island and Aultsville?—A. Yes, Weavers point is just a little distance below Crysler Island. The point in the river where boats' power is taxed is at Goose Neck Island, where the water is very swift.

Q. Where is Goose Neck Island?—A. It is below Morrisburg. It is one of the swift places where the boats hardly move, coming up, and they move slowly at these three points also. There would be no trouble in a boat with half the power of the present ones going from Weavers Point to Montreal. If we built the Crysler project there, and built a side canal we would have no difficulty at all in using low-power boats from there to Montreal. Or if we put a temporary 14-foot lock, and did not build the side canal until we are ready, we might have to do something below—but I do not think so. About 20 cents a ton would be the saving we would make by changing the type of canal boat. I think I have said everything I wish to say, and if you wish to ask any questions I will try to answer them. I must say this question of economics is a nebulous one, in any case. I have not been doing any work on it for six months.

By Hon. Mr. McLennan:

Q. Did you say you were ready for questions?—A. Yes.

Q. What about the type of boats that you referred to earlier—boats carrying what dead weight?—A. We have set up here three types of boats—the canal boat, the ocean tramp with 8,500 tons dead weight, and the lake freighter which I think is 12,000 tons dead weight carrying capacity.

Q. 12,000?—A. Yes, and the ocean tramp at 8,500.

Q. The lake boat you contemplated might cross the Atlantic?—A. No, I never figured on any lake boat crossing the Atlantic; they cannot cross the Atlantic; they would break in two.

Q. 12,000 tons and 8,500 tons, they are two types of boat you contemplate?—A. Yes.

Q. And I gather your opinion is that the smaller boat would disappear, eventually?—A. Yes, it would have to disappear out of the grain trade.

Q. There is always a very large volume of trade that will not take big cargoes—in commodities?—A. Yes, quite right, absolutely. There will be a lot of ocean boats of a smaller size than that would come in. There would be a great many 7,000- and 5,000-ton boats come in. And there will be a great many lake boats smaller than that that will come down to Montreal. As a matter of fact, as you know there are many boats on the lakes only 500 feet long.

Q. Another thing I wish to ask was about your last suggestion, as to deferring the grain trade up slack water—do you mean using something like a barge?—A. No, you cannot use a barge.

Q. An enormous amount of grain is coming down the St. Lawrence in closed barges, smaller units, which are not inconvenient to the grain trade. 8,000 bushels is the unit which you can ship in the grain trade, and grain is not always in enormous quantities of one type of grain, but could be made up of several types. I was interested to know if there was not the possibility of utilizing the big vessel to Prescott, and then send it on from that in a smaller one. Did you consider that?—A. We have considered that in a measure. I say we considered what we could do if the development was put in at Crysler island and nothing else was done for some years, with a boat that would have only 252 indicated horse-power, instead of 850 that the present canal boat has, and would make only $6\frac{2}{3}$ miles an hour, where the present canal boat has to go 10 miles an hour to go through the swift places.

Q. Do you mean 10 miles an hour for the whole?—A. No, I mean that the present canal boat must go 10 miles an hour in order to go up the swift places. We figure that we could reduce the power in the boat, and increase the carrying capacity by 100 tons. And reduce the expense from \$1,934 a trip to \$1,690, and reduce the rate from 83 cents a ton to 69 cents per ton of cargo.

Q. That would be the saving of that type of boat?—A. Yes, we determined the type of boat we wanted, and then submitted it to builders in the Old Country, and got a price from them upon which we based our analysis. It is just a suggestion, that is all. I do not know whether or not the Committee would like copies of this memoranda.

Q. Is that included in the documents already filed?—A. No, but I can include it in the documents I am filing if desired.

Q. Have you that there?—A. Yes.

By Hon. Mr. Lynch-Staunton:

Q. You save 5 cents per bushel on passage from Fort William to England?—A. Yes.

Q. Have you calculated what the saving would be if you had to break bulk?—A. Yes, I gave you that. I gave you that at Prescott, breaking bulk at Prescott, \$1.30 a ton.

Q. \$1.30 did you say?—A. It is $3\frac{1}{2}$ cents plus 6 and a fraction, plus about 8 from Montreal. About 20 cents I think it is.

Q. Per ton?—A. No, per bushel.

Q. Per bushel?—A. Yes, per bushel. You were talking about bushels there.

Q. I thought you said you would have 5 cents per bushel without breaking bulk between Fort William and England?—A. That is about right.

Q. And if you break bulk at Montreal?—A. You would lose about a cent and a half on a bushel.

Q. And if you break bulk at Prescott, what would you lose?—A. Another cent and a half. And if you introduce the little boat you would increase the carrying capacity between the two points to the extent of about 8 cents per ton per hundred miles of actual equivalent lake distance. People think the grain business has a great deal to do with the deep waterways, but it has not; it is not the thing that counts at all and that causes the big savings I speak of. When you move package freight you will find that every time you transfer package freight it will cost \$1.60 a ton. Flour transfer up at Port McNichol where they are well equipped to handle a big volume of it continuously throughout seven months of the year costs about \$1.40 a ton. In ocean ports it is always \$1.60 or \$1.70 a ton. There is data filed which nobody can dispute, in regard to these things.

By Hon. Mr. McLennan:

Q. Is that bulk flour?—A. Yes; the reason the bulk of it goes out by rail is because of the two transfers it would have to take. Take \$1.60 at one end and add \$1.60 at another place—without reference at all to the question of rail against water, and you will find that direct rail haul from New York to anywhere on the great lakes is cheaper than that kind of transportation. So that the potentiality of waterways for doing business and turning in a profit to a country has largely to do with package freight, because package freight comes to the United States in boats now, and whether it is unloaded at New York or at Duluth just means the added length of navigation by boat, which costs only 8 cents per hundred ton miles. And when you start to figure out the cost of sending package freight from Liverpool to Chicago direct by water as compared to shipping it to New York and then by rail to Chicago, the waterways, of course, shows an enormous saving.

By Hon. Mr. Lynch-Staunton:

Q. That 8 cents per hundred ton miles is on ocean mileage?—A. It is on ocean mileage, yes. It is not on canal mileage. If you are going to deal with only the length of canals you will have to equate it. In our small canals our boats only make an average of 4 miles an hour; they make $3\frac{1}{2}$ loaded and $4\frac{1}{2}$ light—an average of 4. A mile of canal is as big a retardation as $2\frac{1}{2}$ miles of lake. With our deep waterways, by comparison of section of boat to section of waterway you will find that large boats will make 5 miles an hour, comfortably. That is based upon experiments through the Suez Canal, the Panama Canal and through our own canals, and other places,—well-known factors. So that a mile of canals, of course, will retard the shipping in our proposed waterway as much as 2 miles of the lake, no more than that.

Q. Do you believe the cost comes in there?—A. Yes, but in our deep waterways the length of restricted navigation is not much. But in all these calculations we speak of the length of canal mileage is taken into account at 5 miles an hour; the length of shallow water is taken into consideration at 9 miles an hour, restricted river is put in at 10 and lakes at 11,—so that the calculation we have set up takes account of these things.

Q. It all brings us down to the eight, in the end?—A. No, this eight I gave you, and that 16, were just to give you a perspective, that is all. The general deductions I made were not based upon eight or sixteen, they were based upon men's wages and upon first cost of ships.

Q. I understand.—A. You can take it anyway you like—take that eight cents I gave you, plus terminal turn-around charges, and you can check that with figures got the other way, and you will not be far out.

Q. The basis upon which you made your calculations differed from the basis in which they are usually made?—A. Yes.

Q. And using the other basis, do they arrive at the same conclusion you do?—A. Generally speaking, yes. But the difficulty in dealing with rates is this: One year rates are low, and another year they are high, and you will get all disjointed.

Q. But rates control the cost, do they not?—A. Yes, if you wait long enough. I was working at that after the war; at that time rates were away up, on the lakes and ocean rates were away down, because there was a surplus of tonnage, and everybody was debating whether he would operate his ship or lay it up. So that you cannot build up on that.

Q. Your conclusions are based upon what a man reasonably ought to expect to make, not upon the actual cost from year to year?—A. Yes, they are made on what he ought to make. And, as a matter of fact, without going into this complication of return cargoes, we always assume that everything is light, and they are all one-way passages—one-way vessels.

Q. Do you mean to say that an ocean ship will come to the top of the Lakes from England, light?—A. I figure so, but I know she won't do that. She will probably strike out in a triangular movement. They do it triangularly—they take a cargo here, and take it there, and go to the third point—triangularly.

Q. You are figuring all light from Montreal?—A. Yes, all light—all analyses are made with light returns.

By Hon. Mr. Beique:

Q. That is the fair way?—A. Yes, the movement out of Montreal is a four-to-one outward movement. If the Great Lakes were opened to the sea, according to the figures we have, it would still be about a three-to-one movement—three out and one in,—something like that. So that you are not far out on that. That way gives the worst case for the waterway anyway so we take it that way.

By Hon. Mr. Lynch-Staunton:

Q. You are not going to carry it out, excepting bulk freight, are you?—A. No, you will have to go over the figures to see. The United States traffic inward will be far heavier than our traffic. New York is two out for one in; it is a big centre of population. The Pacific ports are about 10 out to one in.

Q. 10 out to one in?—A. Yes.

Q. It seems to me that the way you are calculating these vessels will all travel light from Montreal to the upper lakes?—A. The boats that leave Montreal to the upper lakes now only get 15 per cent of their space filled. So that the movement from Liverpool or from the Atlantic to the Lakes would be far better balanced with the waterways built than now, because the bulk commodities that are easily transferred get out pretty well by our canals. But the package freight that comes in to western Canada, comes by rail wholly. If you opened the lakes to the sea the traffic would be a far better balanced business than now. The only thing that would unbalance it would be the grain movement. In the inward movement we would have Welsh coal, and B.C. timber, and have all those things that feed the population, such as sugar and salt; they would all be inward. My figures are subject to attack from all directions as to the propriety of doing one thing after another that I have done. But if anybody wishes to figure other things out, the data is there.

Q. What is your opinion as to whether ocean-going ships will ever come up the canals?—A. I have no doubt about ocean boats coming to the head of the lakes, if there is cargo there for them. The doctrine that ocean boats will never enter a canal is, I think, thought by most of us to be a heresy that is popular in some places. It is like the measles, everybody gets it from his neighbour, in certain parts of the country. However there is this to be said for such a doctrine. Our locks fit our boats very snugly and the currents set up by power drafts at locks are very bad in some places so a strange captain has a bad time. In our future canals we will avoid all that and our locks are very large and have double gates and fill from below and have fender chains so there will not be much to scare people away.

By Hon. Mr. Beaubien:

Q. I understand there are only two points in our canals where there is some restriction, and if these were removed the capacity of our canals would be practically doubled. You said 60 per cent in one case, at Cornwall?—A. The restriction in low-water years is at Morrisburg, and that rules the traffic. The canals cannot carry any more than they are doing, in certain parts of the year.

Q. If that was removed—A. If that was removed the capacity would go up through those low years to what it is at Cornwall, at lock 15 and 17.

Q. I understand that would about double the capacity of our canals, is that right; you did say 60 per cent?—A. I would have to think about that. If you duplicated the locks at Cornwall and duplicated the locks in Morrisburg canal—I would have to think to see whether that would really duplicate the whole system or not. I think it would.

Q. Would that be costly?—A. We figure a 14-foot lock at \$400,000 each.

Q. That would mean \$800,000?—A. I have put it down at a million dollars at Cornwall—to duplicate the locks at Cornwall.

Q. Will that be all that is necessary to duplicate the capacity of that canal?—A. You have not done anything to deal with the situation at Morrisburg yet.

Q. How much would have to be spent there?—A. It is difficult to duplicate it there.

Q. Have you any idea of the cost?—A. No, I have not thought of that phase of it.

Q. Could you not give us an idea at all?—A. No, I could not give you an idea there.

Hon. Mr. REID: How much is it to enlarge the two locks in Cornwall canal?

Hon. Mr. BEAUBIEN: He has given it as a million.

The WITNESS: You can duplicate the locks 15 and 17 and make the entrance wide at Cornwall for about a million dollars.

By Hon. Mr. Reid:

Q. There are two locks in Morrisburg canal; do you mean to enlarge them so that they would be of the same capacity as Cornwall?—A. It would be difficult to do, for two reasons: First of all, the upper entrance is bad at Morrisburg, and the whole canal is only 80 feet wide at the bottom.

By Hon. Mr. Robertson:

Q. Are there more men on the crew of an ocean liner of the same tonnage capacity as a lake boat?—A. The boat we consider here, the crew on the ocean boat is larger. I take the crew of an 8,000 ton ocean boat at \$132 a day for 40 men, and \$105 for 29 men, for a 12,000 ton lake boat.

By Hon. Mr. Reid:

Q. I wish to read out this: (1) The amount of expenditures on the American channel, International Section, between Lake Ontario and Prescott necessary to make a 25-foot channel—do you understand that?—A. No.

Q. The amount of expenditure on the American channel, International section, between Lake Ontario and Prescott necessary to make a 25-foot channel; (2) the same on the Canadian side, that is, on the same territory, between Lake Ontario and Prescott; (3) during that section there are no locks at all; (4) The amount of expenditures on the American side to make a new channel, International Rapids Section, Prescott to Lake St. Francis; (5) the amount of expense, Canadian side, to make a channel, International Rapids Section, Prescott to Cornwall and Lake St. Francis. Now, I would like to explain this. When I say the "cost between Prescott and Lake St. Francis on the American side" I only mean—I do not mean to make the whole thing right over on the American side—but I mean just as you have got it there, only the locks will be on the American side, in one case, and on the other they would be on the Canadian side. The reason, as I have said, is that it is useless to come from Lake Ontario, away up to Port Arthur, and build the channel on the Canadian side, entirely. What do you wish to say?

Hon. Mr. BEIQUE: I have asked what I think, but I leave it to Mr. McLachlan to answer as he considers to be practical.

Hon. Mr. REID: And if he answers that—

Hon. Mr. BEIQUE: And you put your own questions and additions, you see.

Hon. Mr. REID: I am getting at this—

Hon. Mr. BEIQUE: Yes, but get at it, get at it.

Hon. Mr. REID: I want to understand what you mean.

Hon. Mr. BEIQUE: I mean what I have written, and there may be something that is not practical to answer. I leave it to Mr. McLachlan to reduce it to what he considers to be practical. That is all.

Hon. Mr. POPE: If you want to find out what it would cost to build a canal on the waterways, there, just summons that Buffalo Construction Company, and they will not only tell you what it will cost, but they will tell you what they will build it for, and be done with all this guess-work. And they will be prepared to come here any day you want them.

Hon. Mr. DANDURAND: Whom do you mean?

Hon. Mr. POPE: That man knows who; he knows all of them—the Super-power Company, of Buffalo, New York. You invite that company.

The CHAIRMAN: The Super-power Company?

Hon. Mr. POPE: Yes, of Buffalo, New York.

The CHAIRMAN: Will they come voluntarily?

Hon. Mr. POPE: Yes, any time you wish them to come, and they will tell you what they will build it for. There would be no guess-work about it. They have spent \$130,000 looking over the surveys, and so on, that our friends here have made. There will be no use of fooling around.

The Committee then adjourned to meet at the call of the chairman.

MINUTES OF EVIDENCE

TUESDAY, 22nd May 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, etc., met this day at 11.45 o'clock a.m.

The Honourable C. E. Tanner presiding.

The CHAIRMAN: We have with us this morning, Mr. MacCallum, Manager of the Shipping Federation of Canada. If Mr. MacCallum would be kind enough to come forward, we will be very pleased to hear him.

Mr. A. L. W. MACCALLUM, Manager and Secretary, The Shipping Federation of Canada, Montreal, testified as follows:

Sir, I prepared a short statement so as not to take up too much of your time.

By Hon. Mr. Dandurand:

Q. Are you speaking in your own name?—A. I am speaking on behalf of the Shipping Federation of Canada, which was incorporated in 1903. The Shipping Federation of Canada was incorporated in 1903. It is a Canadian Association of steamship owners and agents interested in the ocean shipping trade to the St. Lawrence and to Canadian Eastern seaports. Its membership does not include inland vessel owners or operators. The total tonnage entered in the Federation during 1927 was 1,961,633 gross tons.

"The aims and objects of the Federation are to safeguard the interests of its members in connection with aids to navigation, channel and harbour depths, harbour facilities, pilotage, towage, port charges, etc.

"Since its inception in 1903, the Federation has kept in the closest possible touch with all matters affecting St. Lawrence navigation, in which its members have a vital interest. In 1921, when the question of the St. Lawrence Deep Waterway Project was under general discussion, the Federation strongly opposed the construction of the waterway, on the grounds that from a navigational standpoint the expense to Canada was not justified, and that the building of such a waterway jointly with the U.S. would lead in the long run to loss of sovereign rights by Canada.

"Since the publication of the report of the Joint Engineering Board in November, 1926, the Federation has given further careful study to this whole question and has investigated particularly the economic benefits which certain proponents of the scheme allege will accrue to Canada as a result of ocean vessels being able to proceed beyond Montreal to terminal ports on the Great Lakes.

"The Federation claims that, in its attitude towards the proposed waterway, it is not actuated by any spirit of factious opposition to further St. Lawrence improvements. Its members represent regular line and "tramp" vessels which trade not only to Quebec and Montreal, but to St. John, Halifax, Vancouver, Portland, Boston, New York, etc. The ocean carrying trade is not wedded to any particular port or ports, hence it cannot be claimed that the attitude of this Federation is based on any local interest in the ports of Montreal and Quebec.

By Hon. Mr. Dandurand:

Q. Do they cover the trade from the Great Lakes to Montreal?—A. No, no inland vessel, purely ocean shipping.

"The immense Canadian expenditure involved in the undertaking can be justified only by commensurate benefits to this country. The existing St. Lawrence Canals are used, and any new waterway would be used by Canada, mainly as a channel for the movement of export grain. During 1926, 96 per cent of the Canadian through traffic eastbound on the St. Lawrence side canals, consisted of grain. It cannot be questioned, therefore, that the basic importance to our country of the St. Lawrence route between Lake Ontario and Montreal is that it provides an outlet to the Atlantic seaboard for Northwest grain. The utilization by Canada of the existing waterway for the movement of grain so far exceeds her use of it for all other purposes combined that the proposed expenditure on improvement of navigation could only be justified by reductions in the cost of grain transportation commensurate with the cost of the undertaking.

"Extravagant claims have been made, principally by American proponents of the scheme, as to heavy savings, in grain rates from the head of the Lakes to Europe, which would result from the building of the proposed waterway. These claims vary from 6 to 10 cents per bushel, and undoubtedly much of the American sentiment in favour of the waterway has been built up on the supposition that if the waterway were built, the farmer of the Middle West, and by inference, the farmer of the Canadian Northwest, would save approximately 10 cents per bushel on the carriage of his grain from the head of the Lakes to European Markets. This saving, it is claimed, would be effected by the ocean vessel, which, instead of terminating its voyage at Quebec and Montreal as at present, would proceed direct to ports on the Great Lakes such as Chicago, Duluth and Port Arthur, there loading full cargoes of grain and carrying same direct to the European market.

"The Federation has given special consideration to the possibilities of ocean vessels proceeding beyond Montreal to Great Lakes' Ports through the proposed deep waterway. It has no hesitation in stating that the regular passenger or cargo liners, which now terminate their voyages at Quebec or Montreal, would not use the waterway even if it were built. In practically all cases, the draught of these vessels, when fully loaded, would not enable them to float through the 27-ft. channel proposed. At the present time, many of the larger vessels, on the St. Lawrence route terminate their voyages at Quebec simply because they are unable to proceed up the river to Montreal. In the very few cases where a regular liner's draft might make it possible to pass through the proposed waterway, it is our view that such vessels would not make the trip, as the dangers of manœuvring liners in and out of locks, the high cost of operating such vessels in restricted waters, and the scarcity of high class freight to and from Canadian ports on the Great Lakes, would preclude the successful operation of this type of vessel through the waterway.

"In our opinion the only ocean-going vessels which could or would use the proposed waterway, are transient or 'tramp' vessels carrying bulk cargoes. The smaller vessels of this type which now load full cargoes of grain at the ports of Montreal and Quebec, could navigate to the head of the Lakes, say Port Arthur, load a full cargo of grain there, and proceed direct to European ports. Only a proportion of the tramp vessels carrying bulk grain from Montreal to Europe during the past season of navigation could, however, when fully loaded, utilize a 27-foot channel between Montreal and Lake Ontario. The benefit of the proposed waterway to the Canadian Northwest would therefore be confined to the saving which such vessels would effect, by direct carriage, on the present

all-water rate from Port Arthur to Montreal and thence to Europe, as modified by improvements in navigation and transfer facilities now under way.

"It seems to have been overlooked by many proponents of the deep waterway scheme that the ocean "tramp" does not confine its activities to any regular route. It seeks the most profitable trade and the shipper at any specific port has no guarantee that tramp tonnage will offer itself in sufficient quantity and at a rate favourable to the shipper whenever the latter is ready to export. Cargo space is a commodity equally with grain itself and rates for its use are governed by the law of supply and demand. This is illustrated by the experience of Vancouver in 1926, as stated in the Annual Report of the Harbour Commission, of that year, when owing to the diversion of a large number of tramp steamers to carry coal to the British Isles, vessels of this class were not available at Vancouver in sufficient number to take the grain away, and this shortage of tramp tonnage resulted in rates for the carriage of grain which were disadvantageous to the Vancouver exporter.

"To meet the extra expense and risks involved in proceeding beyond Quebec and Montreal to and from the head of the Lakes, the tramp vessel would have to secure a higher proportionate rate for the inland haul than is now charged by this class of vessel for ocean transportation from Montreal. Calculations based only on distance and time of travel would indicate a maximum saving, as compared with existing all-water rates via the St. Lawrence, of two to three cents a bushel, but the seasonal character of the traffic; the very short period during which grain could be moved by ocean vessels direct from the head of the Lakes, and the dependence of tramp rates and supply of tramp vessels on world wide traffic conditions, would necessarily be reflected in the actual rates. Exorbitant claims of savings, as high as ten cents a bushel, on grain rates from the head of the Lakes to Europe, have been given wide publicity. The absurdity of such claims is evident from the fact that in order to effect such a saving, the tramp vessel would have to travel 1,200 miles beyond Montreal, another 1,200 miles back to Montreal and charge two cents per bushel less for the carriage of her cargo from the head of the Lakes to Liverpool than this class of vessel charged for the carriage of a similar cargo from Montreal to Liverpool during the past season of St. Lawrence navigation.

"Apart from the fact that the probable benefit to the grain grower of the Canadian Northwest, as a result of building the proposed waterway, would be negligible when compared with the cost of construction, it must be borne in mind that the situation of the Canadian grain grower has been, or in the near future will be, materially altered by the following:—

- (a) Further possible reductions in the present cost of carriage via the existing St. Lawrence route due to the Welland enlargement.
- (b) Reduction of freight rates by rail to the Canadian seaboard.
- (c) Shipment of Alberta and Saskatchewan grain through Pacific Coast ports.
- (d) The development of the Hudson Bay route.

In so far as the operation of these factors is concerned, Canada is already committed to the expenditure involved therein, and this irrespective of the proposed deepening of the St. Lawrence channel between Lake Ontario and Montreal.

"If the project is viewed from the standpoint of benefits to import traffic, it will be seen that Canada's situation is fundamentally different from that of United States. Every portion of the Dominion, with the exception of the Northwest provinces, already enjoys water transport facilities, and the situation of the Canadian Northwest has already been improved by the development of the Pacific Coast outlets and is expected to be further improved by the Hudson

Bay outlet. Notwithstanding our highly favourable position for imports by water from transoceanic countries, according to Canadian Government statistics, about 65 per cent of our total imports come from the United States. In regard to this large percentage of our imports, no benefit therefore would accrue to Canada from the deepening of the St. Lawrence channel between Lake Ontario and Montreal."

On the next two pages of this statement there is some statistical information about imports, with the object of showing that, of the imports coming now to Quebec and Montreal, only a small proportion would be available for the type of vessel which could proceed to the Great Lakes. Perhaps I could skip them, and just go on to the conclusion.

Some Hon. SENATORS: Yes.

Mr. MACCALLUM: The import figures demonstrate the point I mention.

"The foregoing figures demonstrate that only a very small proportion of the total freight brought to and discharged at the port of Montreal by ocean carriers during 1926, could be considered as Canadian import traffic available for a deeper waterway between Montreal and the Great Lakes. It is abundantly clear that the need of any deeper waterway, from the standpoint of Canadian import traffic, is far from being a pressing one.

"It seems to have been generally overlooked that the American traffic described as available for the deeper waterway is also the traffic available for the present waterway. This present waterway, which is an extremely valuable Canadian asset, is admitted, even by the proponents of the new deep waterway scheme, to be the cheapest of all means of transportation between the Middle Western States and the Atlantic seaboard. As it now stands, the St. Lawrence waterway between the Great Lakes and the head of ocean navigation provides a splendid inland navigation system, effectively serves the existing Canadian trade, and is of a capacity to meet our requirements for years to come. It is not claimed by this Federation that the existing St. Lawrence waterway has reached its maximum efficiency, as doubtless its transfer facilities can be further improved to meet traffic conditions. It is somewhat surprising, however, that as the present waterway provides the exporter and importer of the Middle Western States with the cheapest route to and from European markets, this route has not been utilized to greater capacity by the American territories tributary to the Great Lakes in spite of the fact that American vessels can make use of the entire system free of canal tolls.

"The completion of the new Welland canal, and the provision of additional transfer facilities consequent thereon is expected to effect reductions in the present cost of transportation of grain from the head of the Great Lakes to tidewater. Any prospective gains to Canada which might possibly result from the ability of small ocean tramp vessels to proceed to the Great Lakes through the proposed deep channel between Lake Ontario and Montreal must therefore be discounted by the effect of the improvements which Canada is now making on her existing all-water system.

"It is our firm conviction that, so far as Canada is concerned, the project is untimely and premature. Before the war we expended very large sums on development of railway transportation facilities far in advance of the needs of our population, and thereby saddled the country with a heavy burden of debt which we still carry. Over-investment in water transportation facilities is certainly not justified by our experience in the matter of railways.

"This Federation is unalterably opposed to international control of Canada's only outlet to the Atlantic, and firmly believes that the National waterway policy under which Canada has brought the existing entirely Canadian waterway system on the St. Lawrence to its present efficient state, at a cost of many

millions expended over a long period of years, should be continued. The Federation contends that an impartial study of the economic situation discloses that the present all-water system via the St. Lawrence offers not only an efficient, but the cheapest, route to Europe for the produce both of the Canadian Northwest and the Middle Western States; that this present route can be utilized to greater capacity and its facilities further improved at moderate cost; that as and when her economic development requires and her financial position warrants, Canada should make further improvements of the navigational facilities of the existing routes, effecting such improvements as a purely national undertaking."

The CHAIRMAN: Gentlemen, have you any questions you would like to ask Mr. McCallum?

Hon. Mr. CASGRAIN: How many trips do those tramp steamers make from Liverpool to Fort William?

Mr. MACCALLUM: If you take the last season of navigation, there was a little over 300 tramps, and their average number of voyages to Montreal was about one and a half. Many came for only one voyage; a number came for two voyages; a few came for three; and I think four voyages was the maximum number.

Hon. Mr. GILLIS: That is, they may go somewhere else?

Mr. MACCALLUM: Yes.

Hon. Mr. CASGRAIN: Would they make more, or less, if they go to Fort William?

Mr. MACCALLUM: I do not think they would make more.

Hon. Mr. McLENNAN: How many voyages does a liner make, taking her as a vessel steadily in trade?

Mr. MACCALLUM: She makes about eight voyages in a season to Montreal, if she has a voyage early in May.

Hon. Mr. McLENNAN: One of the mail boats?

Mr. MACCALLUM: Yes, running four weeks' trips.

Hon. Mr. REID: Is that passenger or freight?

Mr. MACCALLUM: Passenger.

Hon. Mr. REID: Then the freight?

Mr. MACCALLUM: The freighter would possibly make seven. Some freighters are on four weeks' trips, and make eight; if only a five-week trip, they could make seven.

Hon. Mr. DANDURAND: Have you figures showing what proportion of freight is coming to Montreal, and destined to Winnipeg as a distributing point during the navigation season—what proportion of trade transfers to lake boats in Montreal, to utilize the water route to Fort William, as against that freight that goes direct to Winnipeg by rail?

Mr. MACCALLUM: Well, these figures that I omitted in that statement take the imports at Quebec and at Montreal as shown by the Harbour Commissioners' figures, and the distribution of those imports to various points. There is so much by rail. In the case of Montreal there is a large amount of local distribution, some of which may later on go forward by rail. A certain number of tons are transferred to the lake carriers, and then a certain amount are handed over to the railway; but I could not give you the proportion of traffic, say, discharged at Montreal for local distribution; that is to say, consigned to local importers, which later on may be distributed by him to Winnipeg or the west.

Hon. Mr. McLENNAN: In your statement there is on page 8, towards the bottom, a total of 242,308 tons which should go where?

Mr. MACCALLUM: On page 7, the top of the page, it gives the total imports. There are particulars showing the traffic to Montreal, and it shows the Harbour Commissioners' distribution of the total tonnage, over 2,000,000—137,466 tons by rail to Canadian points; 25,356 tons by rail to United States points; 102,689 tons transhipped to vessels; and other distribution, which is really a local distribution, 1,762,540 tons. Later on we have tried to give a fair idea as to the distribution of that traffic, to show that of the total traffic only about 250,000 tons was the kind of bulk traffic which would be available for the type of ocean vessel which we claim would proceed to the Great Lakes.

Hon. Mr. DANDURAND: The idea has been advanced here that a 25-foot channel up the lakes would throw the imports to Chicago largely, which presently come to New York and reach Chicago by rail.

Mr. MACCALLUM: Well, my statement there is based on a 27-foot channel; that is, a vessel that has 25-foot draft; and taking the liner traffic to-day to the port of Montreal, there is practically no liner fully loaded that could float up a 27-foot channel. When she is fully loaded she is drawing 25 feet, 25.6 feet, 26 feet, up to 27.6 feet; a cargo tramp which we consider could go to the Great Lakes would draw from 20 feet up to 25 feet. Last year, if you take all the tramp vessels which carried a full cargo of grain from Montreal, 40 per cent of them were loaded to 25 feet and over, and those vessels could not go up a 27-foot canal—about 60 per cent were loaded to 25 feet and under. If you take a 25-foot channel there was only 40 per cent that could go up, for there was only 40 per cent drawing less than 23 feet.

Hon. Mr. REID: What is the length of those vessels?

Mr. MACCALLUM: 450 to 460 feet.

Hon. Mr. REID: About what tonnage?

Mr. MACCALLUM: Dead-weight tonnage we are considering would be 7,000 to 8,000 tons.

Hon. Mr. CASGRAIN: With 25 feet, 23 feet deep would be the limit?

Mr. MACCALLUM: That would mean that the tramp vessels that carried full cargoes last year, 60 per cent of them would be excluded, that is, if they wanted to load up to full capacity.

By Hon. Mr. Pope:

Q. What is the depth of the new Welland Canal?—A. 27 feet.

By Hon. Mr. Casgrain:

Q. That is 25 feet navigation?—A. Yes.

By Hon. Mr. McLennan:

Q. Your figures show that the United States business by rail is only 25,000 tons. Have you anything that shows imports to the United States by the St. Lawrence route, or would that business have to be created?—A. I think there is a certain amount of traffic. I have here a statement that I think was given by one of the liner representatives in Montreal. You are referring to imports or exports?

Q. The possibility of imports for United States lake ports through Montreal is small now?—A. Taking two cases—I think there were two Cunard boats, and taking their inbound cargoes as a sample, the percentage destined for Chicago and the States was 2.70, just taking two cargoes at random.

Q. Under 3 per cent?—A. Less than 3 per cent.

Q. Either by rail or water?—A. Yes, sir. That is the destination.

Q. In other words, that trade would have to be created?—A. I think so, by an ocean vessel.

By Hon. Mr. Casgrain:

Q. Would a cargo boat have a full cargo for any lake port that you know of?—A. Of course, the type of vessel that we claim would go to the Great Lakes could carry a bulk cargo, she might have a cargo of fertilizer or something, but even the tramp vessels that come to Montreal have not a full cargo. They often come in ballast to get a cargo.

Q. What about going to Fort William?—A. They would not be any better off on the trip to Fort William than they are to Montreal.

Q. That report that you have read has been discussed by the Shipping Federation?—A. Oh, yes.

Q. That is the concensus of opinion of the members of the Board?—A. Yes. We have discussed this matter for over a year, and this was read at the meeting of the Federation. It is not my opinion alone.

By Hon. Mr. McLennan:

Q. Is the Committee correct in assuming that changing ports adds materially to the expenses of a voyage?—A. Going to an additional port adds to it.

Q. Take an inward cargo, for instance, the most economical way would be if it went to Chicago or Detroit or Fort William. If it went dodging along, leaving a few hundred tons at one place and a few hundred tons at another?—

—A. That is a very expensive method of steamship operation.

The CHAIRMAN: Thank you.

TUESDAY, 22nd May 1928.

Mr. THOMAS HARLING, President, Messrs. Thomas Harling and Son, Limited, Steamship Agents, Montreal, appeared before the Committee, and testified as follows:—

Mr. HARLING: Mr. President and gentlemen, the report that you have just heard from the Shipping Federation was drawn up during the winter months, and while I largely confirm the opinions expressed there, I do not think the question of tramp steamers has been quite fully explained.

By Hon. Mr. Dandurand:

Q. Of course I know you Mr. Harling, but would you tell the Committee the experience you have had in shipping?—A. I commenced business in 1873 in Liverpool, in a ship broker's office who loaded vessels to all the North Atlantic ports, in the United States and Canada; in 1883 I commenced business, (owing to the death of my senior), and was in business from 1883 to 1895 in Liverpool. In 1895 I came out to Canada as the representative of Elder Dempster & Company, a large steamship firm in Liverpool, who desired to enter the Canadian trade. Three or four years later that company was absorbed by the Canadian Pacific Railway. They bought the whole service, 14 steamers and the good will of the business. I then became the agent of another company in Liverpool, Frederick Leyland & Company, the Leyland line, who operated a service of steamers to the Mediterranean and also to New York and Boston. I represented that company till 1901, when they were absorbed by the International Mercantile Marine Company of New York—the I.M.M.C. which was commonly known as the "Morgan Combine." Since then I have been in business on my own account again in Montreal, as a Steamship Agent representing a large number of tramp steamship owners.

My experience personally in Montreal commenced from 1890, when I came out to Canada and made a trip through the West as far as Chicago, looking into transportation questions. At that time I was impressed with the importance of the Lake Navigation, and the river St. Lawrence to Montreal, as I

believed the cheaper cost of transportation by water to Montreal would result in a large accession of trade to that which Montreal at that time enjoyed. There were but few regular lines, with comparatively small steamers carrying about three to four thousand tons. The cargo was mixed freight, with very little grain. They only used grain for ballast, the remainder of the cargo being package freight and high class freight, and passengers.

By Hon. Mr. Casgrain:

Q. That is out of Montreal?—A. Out of Montreal. The steamers did not carry more than four or five thousand tons. In going into the grain business at that time, the total shipments amounted to only about 20,000,000 bushels per year. The grain was brought from Kingston to Montreal by barges, and was transferred to the ocean steamers by floating elevators. I came to the conclusion that that system was not the most economical and desirable and during my visits to the West at various periods I looked into the question of large elevators, particularly at Fort William, Duluth, and Chicago, and came to the conclusion that if we were to attract the grain business to Montreal it would be necessary for us to have similar facilities. There was very strenuous objection at that time by the Corn Exchange and the shipping trade to any change in the system. The Corn Exchange did not think it was necessary. But during the regime of the Hon. Sir Wilfrid Laurier and his Ministers, Mr. Tarte made a visit to Montreal, in about 1897, and I arranged a trip down the river, where the members of the Harbour Board and the members of the Government had an opportunity for seeing themselves the disadvantages of the St. Lawrence route. At that time there was no good system of lighting, and a very poor system of buoys, and certain portions of the river were very difficult to navigate. As a consequence, we were confronted with high rates of insurance; steamers to Montreal had to pay two or three per cent extra premium per annum for insurance. The cost of loading vessels in Montreal was not very high; it was much cheaper than at the American ports, but the facilities were entirely inadequate. There were no high level wharves. Only low level wharves with temporary wooden sheds which were erected at the opening of navigation, and taken down in the fall. The Harbour Commissioners about 1890 had a plan for improvements, what was known as the Kennedy plan, which contemplated four piers being built, high level, with permanent sheds on them in the centre of the Harbour. This plan had been before the Harbour Commissioners for a number of years, but they were divided in their opinion. The Government eventually decided to take over the Harbour of Montreal and appoint their own Commission, and they formulated a plan which was afterwards carried out. Part of that plan included the construction of a grain elevator between two of the piers, which I had strongly recommended and from that date on we began to handle grain economically, and the business began to increase.

From that day to the present these facilities have been improved so much that we now have a storage capacity of about 12,500,000 bushels, and can handle a million bushels in and out per day, provided the stream is kept continuous both ways. Last year we handled 195,000,000 bushels of grain without the slightest congestion, the inland carriers obtained a quick turn round for their boats, and the ocean carriers also obtained despatch equal to, if not better than that in any other port in the world. That business, I believe, is still capable of further development. I am optimistic enough to believe that we are doing only a small proportion of the business of the American continent. What we require is increased facilities to develop traffic. There is not a single vacant shed berth in the Harbour of Montreal that is not occupied by a regular line. If another line were to come in now it could not obtain the necessary shed accommodation. It is a very difficult proposition for the Harbour Commission

and the Government to decide, because the centre of the Harbour is now covered with sheds and elevators, and we require to extend. Fortunately the west end of the Harbour was changed to grain loading berths. At Windmill Point the Grand Trunk originally built an elevator which has now been taken over by the Government. All these berths at the west end provide accommodation for tramp steamers without interfering with regular lines. The centre elevator in the Harbour is now almost entirely handling regular line grain. The tramp steamers have at the east end an elevator of 3,000,000 bushels, being increased to 6,000,000 bushels, so they do not interfere with the regular lines.

The success of Montreal as a grain port is largely owing to the fact that the Harbour Commissioners have entire control of every berth in the Harbour. They also control the grain that goes through the elevators, so that when a steamer comes in the superintendent of the elevator decides as to which particular elevator has most of the grain required for the tramp steamer, and then it is not necessary to move. Sometimes we do move to a second elevator, but that is becoming less and less necessary.

I do not think we shall ever exceed in despatch and satisfaction last year's business, because we averaged practically a million bushels a day in and out. If it had not been for the inland carriers—the inland lake boats—we would not have received that business. The railway companies handled only about 19 per cent to Montreal from lake ports, 81 per cent of the grain coming down by water. That, I think, proves the fact that Montreal's advantage as a grain port is a consequence of the cheap transportation of grain from the head of the lakes across the Atlantic.

By Hon. Mr. Casgrain:

Q. You say the inland service is good, then?—A. The inland service is very good. I think there are about 120 canal sized steamers. There has been the objections made that these vessels are not all Canadian owned. The upper lake boats are largely American; the largest boats and the largest number of boats carrying grain on the Great Lakes are American owned. But the grain is brought down to Port Colborne and Buffalo, and is there transferred to the canal sized steamers which bring it to Montreal. The maximum cargo of a canal steamer is about 95,000 bushels. The amount of her cargo capacity is limited by the draught of water in the canal—14 feet—but the canal boats are of the full canal size. They are almost as wide as a canal, and almost as deep as the water in the canal. If it had not been that the inland lake tonnage had been increased, by competition very largely, we would not have as low rates as we enjoy from the head of the lakes to Montreal.

By Hon. Mr. Reid:

Q. Those large vessels would come down the St. Lawrence?—A. If the steamers which now discharge at Port Colborne and Buffalo had the same amount of water that they have in the upper lakes. I understand the Welland Canal will have at least 25 feet.

Q. You have only 19 feet?—A. 19 feet in the upper lakes ports. If they have 25 feet in the Welland Canal they will come down to Kingston or Prescott, or as far east as they can come, because it is more profitable to extend a voyage than to shorten it. A steamer making a long voyage in the Pacific is more profitable than one making a voyage in the Atlantic. They built these steamers in England at a comparatively low cost; most of them came out in ballast. Some of those companies are doing well, and they are increasing the fleet, and say the more inland carriers we get the more grain we will be able to export from Montreal, because that is the business for which they are best adapted.

By Hon. Mr. Casgrain:

Q. Those inland carriers carry say 10,000 tons to Prescott. What proportion of grain would an ocean steamer of the same tonnage carry? It would not be as large?—A. Not in proportion to the tonnage.

Q. How much would it be?—A. Because a lake carrier is of very light construction, and an ocean steamer must be more strongly built, and consequently heavier.

Q. What would be the difference, in your opinion?—A. Oh, I should think perhaps 10 per cent. It is a question of calculation. Those vessels on the lakes carry more dead weight cargo, because there is no limit to the amount they have to carry. Ocean vessels are limited by the draught to the Plimsoll mark, which the Board of Trade says they shall observe. The lake boats, not having to observe that, carry a larger cargo.

Q. But the intrinsic weight of the ship itself?—A. I cannot tell you offhand. I could find out for you.

Q. I wish you would, and let the Committee know. The information we have had is that they carry only 60 per cent?—A. Oh, no. I can produce plans of an ocean steamer which show light draught, and that gives the dead weight of the vessel. If you had before you a corresponding inland vessel, you could see the difference between one and the other.

By Hon. Mr. Pope:

Q. Why do these big vessels not go through to Montreal?—A. Because they cannot go any farther than Port Colborne at present, on account of the canal draft. The limit of the draft at present is 14 feet from Port Colborne.

Q. If the canal were deepened they could go through to Montreal?—A. They could go through to Montreal.

Q. Would that be an advantage?—A. It would be an advantage.

Q. To the growers of the grain and everybody else?—A. That is because you would make a direct connection with the ocean steamer and save a transfer.

By Hon. Mr. Casgrain:

Q. How much would an ocean steamer charge less than the present inland navigation steamer?—A. It is a matter of calculation. The ocean steamers are operating at considerably less per ton than the inland carriers, on account of their working for 365 days a year, whereas the inland carriers operate for only about 220. The proportionate cost of an inland carrier is greater than that of an ocean steamer, in consequence of one working the whole year round and the other for only part of a year.

By Hon. Mr. McLennan:

Q. It was suggested to the Committee that the putting of a dam at Crysler Island, up the river, would make slack instead of rapid water, and that a cheaper vessel with less power than the present canal steamer would lower the present cost. The deep vessel would be utilized to Kingston or Prescott, then instead of the present canal vessel, with which you are very familiar, there could be a vessel which would have less power and therefore would be operated more cheaply, and the cost would be reduced in that 200 miles between the foot of the lakes and Montreal. Have you had any experience or knowledge of that?—A. I agree that that would be the case. The vessels at present—I am speaking under correction—the present vessels cost about \$150,000.

By Hon. Mr. Casgrain:

Q. Which class?—A. The ordinary canal boats.

By Hon. Mr. Reid:

Q. Present size?—A. Present size, 2,000 tons capacity. If those vessels which operate to-day from Port Colborne and Buffalo to Montreal were only required to operate from Kingston or Prescott to Montreal, their efficiency would be doubled, because the distance is about one-half. The question as to whether these vessels would be thrown out of commission would depend on whether a vessel could be designed of a more economical type to carry the grain the shorter distances down to Montreal. I believe it could; in fact I am satisfied. Barges would be provided instead of steamers, with their own propelling power. That is to say, these vessels which now operate could either tow a barge with them, or a Diesel motor engine could be used. This would reduce the number of men to probably one-half of the present requirement, and the cost of handling grain from Kingston to Montreal would be a very small amount as compared with the present cost from Buffalo and Port Colborne to Montreal. The rate to-day from Port Colborne to Montreal is about 6 cents per bushel. The rate from the head of the lakes to Montreal is about 9 cents a bushel.

By Hon. Mr. Casgrain:

Q. That is right.—A. Now, if the rate to-day is 9 cents per bushel from the head of the lakes to Montreal, 1,200 miles, the proportion of cost from Port Colborne to Montreal is excessive, from the standpoint of the economical handling of the grain. If the large steamer comes down as far as Kingston or Prescott, I believe the grain can be handled for one cent or one and a half cents a bushel.

Q. That is right.

Hon. Mr. REID: That is what I say.

By Hon. Mr. McLennan:

Q. From Prescott to Montreal?—A. From Prescott to Montreal. In fact there are several alternatives. There is a question as to whether a railway could not be built. But I do not think the barge can be beaten by the railway, even the most economical railway that could be constructed.

Q. What would be the cost of transfer, in and out?—A. The same, about one cent a bushel.

Q. About one cent for both?—A. They figure the cost of handling grain in and out at one cent a bushel. That is loading and discharge.

By Hon. Mr. Casgrain:

Q. And five or six days' storage, or perhaps ten days'?—A. Well, the more economical the boat the more storage they could afford to give. The present canal boat cannot afford to store. She stores in the winter months, I admit, but not in the summer season, the season of navigation. But if you had barges they would cost so much less per day that then you could afford to hold and store at a very economical figure. With that equipment I do not think that Montreal can ever be beaten by any Atlantic port.

By Hon. Mr. McLennan:

Q. Would transfers be detrimental to the grain?—A. The less transfers you have, the less the cost.

Q. But as to the quality or condition of the grain?—A. No; sometimes it is an advantage to turn it over.

By Hon. Mr. Casgrain:

Q. But the cheapest of all, on the canal for instance, is one steamer and two consorts—two barges?—A. Of course it is difficult to tow barges through canals, on account of the locking, but there is no doubt they would be very considerably cheaper than the present system, because you would cut that rate in one-half at least. If the rate is, say, 5 or 6 cents to-day from Buffalo, that makes it from Kingston to Montreal 2 cents, and I think, even possibly less than that.

Q. That is where the whole saving is, between Prescott and Montreal. The route farther west remains the same; so the whole saving is confined between Prescott and Montreal.

Hon. Mr. REID: Port Colborne and Montreal.

Hon. Mr. CASGRAIN: No, when the vessel comes down.

Mr. HARLING: If you take the large steamer from the head of the lakes to Kingston or Prescott, she can carry at proportionately less cost than to Buffalo or Port Colborne.

By Hon. Mr. Casgrain:

Q. She would carry for four cents to Prescott; then you would have to add another two cents from Prescott; that would be six cents, instead of nine cents as to-day. Isn't that right, Mr. Harling?—A. That is right. What we need in Montreal particularly is more facilities. I have been agitating that for thirty years, and I am still agitating it. I say we have not enough accommodation. It is a strange fact that when vessels come in to-day we have not got berths for them. Now, the tramp steamer, not having its regular berth, naturally suffers very much, and as a transfer point this year we are not successful. There are large increases in imports of heavy freight. For instance, there are eighty or ninety thousand tons of ore coming from the west coast of Africa, through Montreal, for Chicago. That has to be transferred to lake steamers. There are large quantities of other commodities going to lake ports. There is coal to Toronto. It is very much more expensive to handle coal, even by water, through Montreal, if it cannot be discharged and it has to go up in smaller boats. Smaller boats, or lake boats, are taking coal to Toronto, but that is not as economical as to have the ocean vessels discharge it in Montreal and transfer it to barges and send it from there inland. But the business that we are doing is changing every year. I have been over thirty years in Montreal and I have never seen two years alike. This season is entirely different from last. But, if it is any satisfaction for the Senate Committee to know, I visited at least one hundred ship owners last winter, representing vessels that came to our consignment and came to Montreal last year, and there was not one single complaint made against the method or the expenses of the Port of Montreal. In fact the principal desire was to get the business again this year. Unfortunately our conditions are very bad just now and we have had to send a great many steamers away.

Q. But as to the coal that goes from Montreal to Toronto, have you any idea how much goes?—A. Very little.

Q. Because it meets coal that is coming down the other way.—A. No. That is anthracite. Anthracite is only a very small quantity, because it cannot economically be shipped west of Montreal.

By Hon. Mr. Dandurand:

Q. Mr. Harling, you have spoken of increased facilities for the boats that would come direct from Fort William to Kingston as a point of transfer, and thence to Montreal. If the navigation or canalization were increased to 25

feet to Montreal, where would you make the point of transfer? Montreal?—A. Yes, Montreal or Quebec.

Q. All right, but if those boats can come down and go up with a draft of 25 feet, can they not go direct to Liverpool, and from Liverpool direct to Fort William?—A. Undoubtedly.

By Hon. Mr. Casgrain:

Q. Economically?—A. Economically up to a certain size.

By Hon. Mr. Reid:

Q. Mr. Harling, I have been informed that the boats that run to Port Colborne and will go on through to Kingston or Prescott carry about 12,000 tons, or they are about 600 or 700 feet long. Is that right?—A. Yes, about 600 feet, I think.

Q. Well, those boats will come down to Kingston or Prescott, I suppose, when the Welland Canal is completed?—A. It depends upon the length in your canal locks.

Q. At the Welland?—A. At the Welland.

Q. At the Welland, of course, they are plenty long enough for a vessel 600 or 700 feet long. At all events they are long enough for a vessel to go in there and out. Could vessels of that length navigate to Montreal safely?—A. Yes. I do not see any practical difficulty in navigating the largest vessel, if the necessary facilities are provided. The same complaint was made, I remember, years ago in Liverpool when the Manchester Ship Canal was built. The Liverpool ship owners said, "Our steamers will never go to Manchester, because they will not be able to navigate through the canal." As a matter of fact the Manchester Ship Canal is an undoubted success to-day.

By Hon. Mr. Casgrain:

Q. With the help of tugs.—A. Well, they do, naturally, the same as we do in Montreal. We do not dock and undock a vessel without the assistance of a tug.

Q. You would need the assistance of a tug with those big 12,000-ton boats.—A. The same as they do in the Panama Canal, and the same as in the Manchester Ship Canal.

Q. No; at Panama they have locomotives to do the work.—A. We have not reached the stage of dealing with the facilities to be provided, if they ever are. In the lower St. Lawrence, if the canal is ever built, I am satisfied facilities will be provided that are necessary to handle vessels of the largest size there.

Q. Have you been through the Panama Canal?—A. No, but I know about it.

By Hon. Mr. Reid:

Q. What do you think of those large liners we have on inland waters, like those of the Canada Steamship Company and others? They have large steamers that run from Lake Superior, say, to Port Colborne. Would there be a possibility of their coming down to Kingston or Prescott and trans-shipping into cheaper vessels that they themselves own, in order to go back and get another cargo?—A. That is an economical question, and it is entirely for the companies themselves to decide. If it is more economical for them to make a short trip they do in some cases, no doubt, transfer their passengers. The same thing would apply to freight, but in handling freight it is more economical to go straight through to destination than to break bulk.

Q. The only reason I asked that question was this. From Kingston or Prescott it is lake navigation almost all the way through. The Welland Canal is about the only exception.—A. Yes.

Q. From Prescott down———A. It is more difficult undoubtedly.

Q. There is more canalization.—A. More locks; and the more locks the more difficult.

By Hon. Mr. Casgrain:

Q. Yes, in restricted channels. You mentioned at the beginning that you told Sir Wilfrid Laurier it was very hard to navigate. That was below Montreal?—A. Yes.

Q. Do you think it is going to be any easier above Montreal?—A. We have improved the St. Lawrence to Montreal so that vessels of 600 and 700 feet come to Montreal, whereas years ago it was said it was almost impossible for vessels of over 400 feet to navigate. When we suggested it was possible to have vessels up to 600 feet in Montreal, they said, "It will never be done." Of course, since then the navigation of the River St. Lawrence below Montreal has been improved: the channel has been widened and deepened, so that we get 600-foot steamers up to Montreal, whereas it was thought a few years ago, comparatively, that it was impossible for us to get anything more than 400 feet. But with the engineering facilities which are provided to-day it is very difficult to say what will or what will not happen. It was said that the vessels would not go through the Panama Canal: there were 27,000,000 tons that went through the Panama Canal last year.

Q. What do they charge a ton at Panama?—A. Their revenue was about \$24,000,000.

Q. But how much do they charge for one ton?—A. About 65 cents, based upon the vessel's dead weight.

Q. And at the Suez?—A. It is about forty, I think.

Q. I thought it was four shillings.—A. It depends upon the register tonnage of the vessel. It is not measured by the dead weight of the cargo carried. It is measured by the vessel's register tonnage. So of course if you put the thing on the registered tonnage naturally it is more than if it were carried on dead weight of cargo. You asked about dead weight and I gave what I thought was a correct figure on the dead weight of the vessel.

By Hon. Mr. Reid:

Q. My question had reference to transferring with the present canal system. The question I asked was this: Even if we have the canals enlarged, don't you think that the vessels will transfer at those points, on account of the season being short? Don't you think that the large vessels will go back to Lake Superior as soon as possible for another cargo, and those Diesel engine boats will take the cargo down? The demurrage or anything of the kind would not be so great, and more grain would be carried.

MR. HARLING: Well, in the short season of navigation the brief voyages that are made are the most important. They are more economical for a vessel. It is more economical for a vessel to discharge at even Port Colborne and come back. But in the summer season when things are slack, the longer the voyage or the longer the vessel can be occupied on the voyage the better. In that case they will want to get the extra freight even though the voyage may take a few days longer. In the spring and the fall of the year when the demand is greatest quick despatch is the most important, and then the management of a vessel decides it is more economical to discharge up the river and go back and get another cargo and take it up; but if the demand is not great he would want to keep his vessel employed.

HON. MR. CASGRAIN: How long does the ordinary vessel take to go from Port Colborne down to Montreal?—

MR. HARLING: Three days.

Hon. Mr. CASGRAIN: And going up it would take about three and a half to four days?

Mr. HARLING: A little longer.

Hon. Mr. CASGRAIN: So that by that time a big cargo boat could be at Fort William and back.

Mr. HARLING: Yes, about that.

Hon. Mr. CASGRAIN: Then those six hundred footers, if they came east of Port Colborne, they would have to move much more slowly than the small ones. I am informed they would take nine days for the trip.

Mr. HARLING: It is more difficult to handle a four hundred foot steamer than a boat of two hundred feet. I think the barge—the economical barge system from Kingston will be the most economical in the end; and from what we know of Montreal, if Montreal is going to take care of this business there must be increased facilities to handle the business, because we think Montreal is doing a big business when we handle about one thousand steamers or twelve hundred steamers a year. If that canal is built, the amount of cargo available from the immense area of United States and Canada being considered, that will only be a fleabite compared with the amount of cargo that will eventually develop.

Hon. Mr. CASGRAIN: In wheat?

Mr. HARLING: Not necessarily in wheat—in all commodities. It has been demonstrated fully that in regard to the traffic that has gone through the Panama canal, even the most optimistic would not have believed that in a few years twenty million tons of cargo would have gone through that canal. And most of that cargo—I cannot give you the exact proportions—is stuff which comes from the eastern states and is shipped to the western states or is grown in the western states and brought to the eastern states. Now, although the railways have been affected, I believe the natural increase in production, on account of cheap transportation, is the cause of that very large business.

Hon. Mr. CASGRAIN: That twenty million tons through the Panama canal is only a fourth or a fifth of what goes through the canal at Sault Ste. Marie.

Mr. HARLING: When you refer to that question, I remember well forty years ago when I went over to England and told shipowner friends in Liverpool that there was more business on the Great Lakes than the combined tonnage of Liverpool and London in a year, they would not believe me. That tonnage has increased from forty million until it is nearly one hundred million to-day. Out of that one hundred million tons which is limited to transfer from one point to another, I think 65 per cent is ore, about twenty-five per cent is coal, and about ten per cent is grain. Now, we are handling the grain from Fort William through the port of Montreal very largely, except the large quantity that goes to Buffalo; but that is only ten per cent of the traffic that is now on the Great Lakes. If it is one hundred millions to-day, what would it be if we had a through canal, and if they were open to the ships of the world. There would be an immense quantity, there is no question; because it would then be economical to arrange for the shipments from Chicago and other lake ports; package freight, and everything else which now goes by rail, could go by water.

Hon. Mr. REID: Do you know what the rate on grain is by rail from, say, Prescott to Montreal?

Mr. HARLING: I could not tell you what it is. It used to be three cents a bushel, but that was when they had about twenty-five cars to a trainload.

Hon. Mr. REID: Three cents a bushel. I suppose it would be cheaper now on account of the larger cars?

Mr. HARLING: Yes, I think they could handle it for considerably less. Of course, the cost of railway transportation has increased; it is higher to-day than it was twenty-five years ago—much higher; but then that cost of transportation would depend upon the equipment and the handling facilities. It is really the cost of handling in and out of the elevator that makes the cost more. Of course, to-day, we have dump cars. We do not discharge the cars by hand as we used to do; the bottom drops out of the car and the car is discharged in two or three minutes.

Hon. Mr. REID: They used to have an elevator at Prescott and transferred the grain there. The C.P.R. used to take it down in five or six hours.

Mr. HARLING: The fact has been proved and demonstrated that the railway companies cannot economically handle the grain to-day, otherwise there would be more business at Goderich and Port McNicholl and these other ports.

Hon. Mr. REID: That is a long haul. I think the barges can handle it. The barges are the cheapest things.

Mr. HARLING: The system of barges will no doubt follow as on the Continent.

Hon. Mr. CASGRAIN: The barges do not require a draught of twenty-five feet. The barges which you say are the cheapest do not require any twenty-five feet draught; fourteen-foot draught is quite good enough for the barges.

Mr. HARLING: Plenty. The distance from the head of the lakes to Montreal is twelve hundred miles, six days up and six days down. That is what is figured from the head of the lakes.

The CHAIRMAN: On behalf of the committee I want to convey our thanks to Mr. MacCallum and Mr. Harling for their goodness in coming up from Montreal. We are very deeply obliged.

The committee then adjourned to the call of the Chairman.

MINUTES OF EVIDENCE

TUESDAY, 29th May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River met this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

The CHAIRMAN: We have in attendance this morning Mr. Harvie, General Manager and Secretary of the Harbour Commission of Montreal, and Mr. Ferguson, Assistant Manager. We will first hear from Mr. Harvie.

Hon. Mr. McDUGALD: Before you go on with Mr. Harvie, as Chairman of the Harbour Board, and also as a member of the Canadian National Advisory Committee, I would like to make a few remarks. First of all, I regret very much that I was not here at the meeting of the Committee when the representative of the Shipping Federation was present, and at once I would like to say that I have the highest regard for the Shipping Federation of Canada, and for the personnel of that organization. Their function, or the object of their organization, is to safeguard ocean navigation. They are there to look after the interests of the transatlantic companies, and their interests in navigation largely ends at Montreal, where ocean ships stop. I would be quite satisfied with the testimony they gave if they had confined it to the question of whether ocean shipping should stop at Montreal or go to the head of the lakes, because that is one of the questions on which they can speak with authority and one which is disturbing the minds of the citizens of Montreal and the Province of Quebec. I think they answered that question to my entire satisfaction.

In October, 1927, Colonel Gear, who is Vice-President of the Shipping Federation, (whose manager and Secretary testified here) and, I may say, the dean of ocean-shipping interests, in an interview given to the Montreal Standard in 1927, which I have in my hand, and from which I would like to quote, so that it may go on record, said: "I am not opposed to the deepening of the waterways, but am in favour of it." That is a definite statement by Colonel Gear, vice-President of the Shipping Federation. He goes on to say: "...but only on the condition that it is done by Canada when she can afford to do the work."

Now, Gentlemen, I submit that the recommendation of the National Advisory Board answers that objection, as you will see, if you read the recommendation. The Board recommends to the Government that the cost of the International Section be borne by the United States Government, and that that section be turned over for the use of Canada free of all charge. As to the National Section, that is that part of the waterways wholly in Canada, we are advised that all the work in the Quebec Section would be done and carried on by Canada, and that the United States would have no interest in it whatsoever, except for use for the purpose of navigation under the Treaties. We suggested that the development of power in that section would be made to pay for navigation, so I submit at once that if the report of the National Advisory Board be adopted by the Government and carried out, the condition stated both by Colonel Gear and the Shipping Federation is met. First, there will be no cost to the Federal Government; the International Section will be built by the United States Government, and the National Section at the expense of power.

Hon. Mr. CASGRAIN: In whose territory?

Hon. Mr. McDUGALD: That is a question of engineering.

Hon. Mr. REID: You say the United States Government will build the International Section?

Hon. Mr. McDougald: Yes.

Hon. Mr. REID: That is following out the Report of the Joint Waterways Commission.

Hon. Mr. McDougald: Yes.

Hon. Mr. REID: That is building it all in United States territory.

Hon. Mr. McDougald: That again is a matter of engineering. But the fact remains, as revealed in the tables of the costs of waterways developments produced by Mr. McLachlan, that fully two-thirds of the improvements on the waterways from Sault Ste. Marie to Prescott have been built and paid for by the United States Government, some of the outlays made being upon channels wholly on the Canadian side of the boundary line, and they have paid for the upkeep, the buoying, patrolling and lighting of that whole International Section.

Hon. Mr. REID: We could argue that again. You say "built by the United States Government." Are you aware that if that is undertaken it will be built by the Aluminum Company?

Hon. Mr. McDougald: That is neither here nor there. You may say that any works carried on here would be built by the Shawinigan or Montreal Light Heat & Power interests in Montreal. We have no interest in that.

Hon. Mr. REID: We have an interest in controlling it.

Hon. Mr. McDougald: That is a matter of regulation by the Government. That is all I have to say about that. I have also been charged by the Press of Montreal and by citizens of Montreal of being one who is conniving in a "plan" or "scheme" calculated to destroy the port and harbour of Montreal. At once I want to go on record as saying that the port and harbour of Montreal is more vitally interested in this scheme than any other institution or part of Canada. I am not alone amongst those in Montreal concerned in the affairs of that port and harbour who have supported the project for deepening the waterways and canal system. It is no new thing, and I would like to put on record the report of the Harbour Commission in 1920, when Mr. W. G. Ross was the President, and the other Commissioners were Mr. Farquhar Robertson and General Labelle. At that time, you will remember, the International Joint Waterways Commission, following investigations and hearings extending over a year, were about ready to bring in their report. The Harbour of Montreal was naturally vitally interested in the findings, and contained in this report are letters and documents exchanged between the two bodies. The result of the investigations made by the Harbour Commissioners and their officials at that time you will find in this report of 1920 at page 29. It is not very long, and I think it should go on record:

At the meetings of the "International Joint Commission" held in Montreal on October 8 and 9 Mr. William G. Ross, President, the Montreal Harbour Commissioners, presented the following statement:

QUESTIONS RELATING TO THE BENEFICIAL USE OF THE WATERS OF THE ST.
LAWRENCE RIVER BETWEEN THE LAKES AND MONTREAL IN THE BEST
INTERESTS OF THE UNITED STATES AND CANADA

Statement of the views of the Harbour Commissioners of Montreal on

1. The desirability or otherwise of the suggested Deep Waterway.
2. Its probable effect on the Development of Commerce between Lake Ports and Ocean Ports.
3. Influence on Industrial Development.

4. Effect if established on existing or other projected Water Routes between the Great Lakes and the Atlantic.

5. Advantages or disadvantages of combined Power Development with Improvement of Navigation on the Upper St. Lawrence.

6. Other phases.

Hon. Mr. MURPHY: Is that a special report or is it the Annual Report?

Hon. Mr. McDUGALD: This is the Annual Report for the year 1920.

Then they go on and deal with those questions.

1. The Commissioners are of opinion that it is desirable to improve the present St. Lawrence Canal System or other Waterway to the extent of facilitating the larger lake boats' access to the Port of Montreal. They are of opinion that such improvement should not extend beyond a fair margin of draft for such vessels.

2. The effect on the development of the Waterway between Ocean and Lake Ports would be of advantage in the economy of time of lake vessels and consequently lower rates of freight. They are of the opinion that the type of vessel suitable for Lake traffic is not suitable for ocean traffic, and that the ocean type of vessel, on the other hand, would not be able to compete with lake vessels on inland service.

3. The industrial effect would only be beneficial in conjunction with Power Development.

Hon. Mr. McDUGALD: I want you to note that specially, because the Advisory Board felt that power and navigation should not be divorced. Now I come back to the opinion of the Commissioners:—

At the present time (and they presume in the further development of the St. Lawrence Canal system) the traffic through the canals is free, not only to Canadians, but is free to United States vessels. Consequently, in order to meet the interest on the cost of such a policy, Power Development is essential and would benefit the adjacent territory in the development of Industrial Enterprise. With sufficient safeguards as to ownership and control of Power Development, as well as of distribution, the Industrial Development would be extensive and of great advantage to the country.

(4) The effect of the Waterway upon the New York State Canal System is a matter for the consideration of the people of the State of New York.

The effect on the St. Lawrence Canals would be that they could be used as industrial or Local Feeders.

The effect on the proposed Georgian Bay Ship Canal may be judged by the fact that the two Ship Canals would not be necessary, at least for many years to come.

(5) The advantages of Power Development are the great advance in price of coal. The probability of its always commanding a high price, and the fact of our depending to a very large extent on the United States for this commodity, placing this country in not only a precarious position, but affecting the exchange situation between the two countries; also placing manufacturing in a better position to compete not only in domestic goods, but foreign export, by inducing industries to establish here with cheap power.

The Commissioners are strongly of the opinion that no further Hydro Electric Development of Power on the St. Lawrence should be permitted until an ultimate plan has been decided on and developed, that would satisfy Canadian interests and safeguard the navigation of the St. Lawrence. The development of both should go hand in hand.

(6) With regard to other phases, Canadian Navigation is being jeopardized now by the diversion of the natural waters of the St. Lawrence and steps should be taken to remedy this state of affairs. The diversion at Chicago should never have been tolerated. The arrangement tentatively agreed to has never been adhered to but has been greatly exceeded. If it cannot be stopped altogether, it should at least be limited to the quantity specified in the arrangement and proper supervision should be given to see that it is, and that through the proposed development and regulation of the St. Lawrence waters, the diversion of the Great Lakes waters be safeguarded.

Sufficient draft for the large lake vessels of say 20 foot draft would allow of Power Development and regulation of flow at a cost that the revenue might to some extent help meet the interest. To increase the depth of the waterway, the cost would be in greater proportion owing to considerable reaches of the river having to be dredged, as well as the more extensive and expensive works necessary with doubtful adequate results. This expense, the Commissioners are of the opinion, would not be justified, as the expense of transferring the large portion of the freight to be handled is done at a minimum of expense at Montreal and would be much less than the extra cost of ocean boats using the waterway, and interest on the cost.

The Commissioners are of opinion that whatever scheme is evolved that Canada's interest should be carefully safeguarded, especially if proceeded with at the present time, as, owing to the present strain on the finances of the country and the fact that large sums will be required for the harbours of the country, as well as the urgent necessity of the deepening and improvement of the Channel from Montreal to the sea to meet the continued growth in size of ocean vessels. No detrimental arrangement should be made with the United States due to their commanding ready financial resources. That would give them a preponderant advantage either in control or distribution of Hydro Power for the development of their industries, to the detriment of Canada.

Hon. Mr. McDUGALD: I want the foregoing to go on record, simply to show that this waterways question has had deep and intensive study by other bodies for the last fifteen years or more, and that my immediate predecessors at the Harbour of Montreal had eight years ago presented their considered conclusions and recommendations to the International Joint Commission at one of its stated hearings.

I took it, Mr. Chairman, that the Committee was looking for accurate information on this waterways question. Here are two bodies of Harbour Commissioners of Montreal of diverse political views administering that port and harbour in the period from 1912 to 1928 in substantial unison upon the main project and the need for carrying it out.

In all the deliberations of the National Board, of which I was a member, I think you will agree that it was natural and fitting that I should confer with the technical staff of the harbour on all questions affecting the harbour of Montreal; and in order to facilitate matters, I have prepared a series of questions to be asked Mr. Harvie and Mr. Ferguson. I submitted the questions to them and asked them to prepare replies so that there would be no question about what they would have in their minds. Then, of course, any member of the Committee may ask any questions he sees fit.

Hon. Mr. MURPHY: Are they technical men?

Hon. Mr. McDUGALD: Mr. Harvie is General Manager of the Port of Montreal, and Mr. Ferguson is the Assistant Manager.

The CHAIRMAN: I think that is very satisfactory.

T. W. HARVIE, General Manager and Secretary of the Harbour Commission of Montreal, was called as a witness:

Hon. Mr. McDUGALD: I would first ask Mr. Harvie to outline his experience in his present position.

Mr. HARVIE: I have had about 35 years experience in engineering and the administration of public works. From 1894 to 1899 I was with a firm of engineers engaged in general engineering and surveying work. From 1899 to 1902 I was Assistant Resident Engineer on railway construction on the Caledonian Railway, now the London, Midland and Scottish; from 1902 to 1907, I was Resident Engineer on Harbour Construction in the Harbour of Glasgow; from 1907 to 1910 I was agent and Chief Engineer for Sir Robert McAlpin and Sons, on dock construction on the Clyde; from 1910 to 1913 I was Assistant Engineer on the 1909 scheme of harbour extension in Montreal; from 1913 to 1922 I was Assistant Chief Engineer of the Port of Montreal; from 1922 to 1924 I was Chief Engineer of the Port of Montreal; from 1924 until now, I have been General Manager of the Port of Montreal, which position I still hold.

Hon. Mr. McDUGALD: How many years have you been with the Harbour Commission?

Mr. HARVIE: 19 years. I am a member of the Institutions of Civil Engineers, London, a member of the Engineering Institute of Canada and a member of the Corporation of Professional Engineers of Quebec.

Hon. Mr. McDUGALD: What contacts do you maintain with shipping and transportation interests and trade generally?

Mr. HARVIE: As the Port of Montreal is the most important centre in the Dominion of Canada of overseas foreign trade with the east, and served by all sorts of ocean boats, liners, tramps and freighters, by all the great transcontinental rail roads, by the great inland shipping lines and every other manner of transportation, it is inevitable that I am in close and constant contact with all of them; in fact, with every trade interest in Montreal, and every form of commerce that takes place there.

Hon. Mr. McDUGALD: Will you state briefly the relationship between the Port of Montreal, as a port, the channel below, and the channel above Montreal?

Mr. HARVIE: The port of Montreal is the point of interchange between ocean traffic and inland traffic. The channel below Montreal is the corridor of access to the Port of Montreal for ocean ships. The waterway above Montreal is the most important feeder of merchandise of all kinds, mostly bulk merchandise, from the West. The Port of Montreal is the connecting link between the two—the point of interchange.

Hon. Mr. McDUGALD: Would you state briefly the growth in the business of the Port of Montreal during the past few years, from 1921 to 1928, and if you have a statement, would you put it on file?

Mr. HARVIE: I think the growth of the Port of Montreal may be most readily demonstrated by a perusal of the annual revenues, the shipping tonnage, the total tonnage of merchandise handled, the quantity of grain handled and the quantity of coal imported. Grain is the greatest export, and coal the greatest import. I have figures for these various years here. Perhaps if I mention the first year and the last it will save time. The revenue of the port of Montreal in 1921 was \$2,891,274.42; in 1927 it was \$5,453,951.56. The aggregate of net registered tonnage of shipping in 1921 was 2,891,956 net registered tons; in 1927 it was 4,992,486 tons, net registered. The year 1927 is just about double 1921, just as the revenue is.

Incidentally I might say that in the last twenty-one years the revenue of the Port of Montreal has doubled almost exactly every six years. The total

tonnage of merchandise handled in 1921 was 6,223,924; in 1927 it was 11,921,173 tons weight. The grain exported, or delivered out, in 1921 amounted to 138,453,980 bushels; in 1927 the corresponding quantity was 195,247,914 bushels.

The greatest bulk import, coal, in 1921 aggregated 1,042,716 tons, and in 1927 it was 2,448,477 tons. I have a comparative statement of those figures, sir.

Hon. Mr. CASGRAIN: Better file that.

(The statement referred to is as follows):

HARBOUR OF MONTREAL

COMPARATIVE STATEMENT OF BUSINESS DURING THE YEARS 1921 TO 1927, INCLUSIVE

Year	Revenue	Shipping tonnage	Total tonnage of mer- chandise	Grain	Coal
	\$			bus.	tons
1921.....	2,891,274 42	2,891,956	6,223,924	138,453,980	1,042,716
1922.....	3,460,810 87	3,932,637	8,585,131	155,035,817	2,009,917
1923.....	3,721,159 99	3,728,740	7,506,872	120,107,990	1,660,009
1924.....	4,382,115 25	4,096,332	8,985,589	165,139,399	1,833,605
1925.....	4,749,100 69	5,104,313	9,137,281	166,212,335	1,697,143
1926.....	4,632,599 92	4,221,730	9,210,699	135,897,882	1,887,988
1927.....	5,453,951 56	4,992,486	11,921,173	195,247,914	2,448,477

MONTREAL, May 28, 1928.

Mr. HARVIE: The number of ocean ships, which is not in that statement, in 1921 was 964, and in 1927 it was 1,610.

Hon. Mr. REID: What about the lake boats? Have you those too?

Mr. HARVIE: No, I did not put them in.

Hon. Mr. L'ESPERANCE: Has the tonnage increased proportionately to the number of ships?

Mr. HARVIE: No. The number of ships, as a rule, is smaller, by proportion, than the tonnage, because very much larger ships are coming.

Hon. Mr. CASGRAIN: That is what he asks about.

Hon. Mr. L'ESPERANCE: That is what I wanted to know.

Hon. Mr. CASGRAIN: Ships are getting bigger all the time.

Mr. HARVIE: I think that is about the most I can say with regard to the growth of the port.

Hon. Mr. McDUGALD: Would you compare the business of 1926 and 1927 with the business of 1910 and 1913? If you have a statement, file it.

Mr. HARVIE: Again, that can be best compared, I think, by taking the revenue, the shipping tonnage and the grain. These are the three principal items of that first period, the other items that I mentioned before were not so prominent. From 1910 to 1913, inclusive, the gross revenues per annum range from \$794,827.92 to \$1,361,964.06 in 1913. In 1926 the revenue was \$4,632,599.92, and in 1927, as I have already mentioned, it was \$5,453,951.56. The number of ships and the aggregate net registered tonnage of shipping for the years 1910 to 1913, inclusive, are as follows. The number of ships ranged from 747 to 820. In 1926 and 1927, respectively, the number of boats was 1,421 and 1,610. The tonnage in the first period ranged from 2,233,222 tons to 2,690,535 tons. In 1926 it was 4,221,730 tons, and in 1927, 4,992,486 tons.

The grain in 1910 was 26,893,605 bushels; in 1913 it was 63,345,788 bushels; in 1926 it was 135,897,882 bushels; and in 1927 it totalled 195,247,914 bushels.

Hon. Mr. CASGRAIN: You want to file that too?

Mr. HARVIE: Yes, sir.

(The statement referred to is as follows):

HARBOUR OF MONTREAL

COMPARISON OF BUSINESS DURING THE PERIODS 1910 TO 1913 INCLUSIVE, AND 1926 AND 1927

Year	Revenue	Shipping tonnage		Grain
		Boats	Tonnage	
	\$			bus.
1910.....	794,827 92	747	2,233,222	26,893,605
1911.....	912,255 23	762	2,338,252	25,169,702
1912.....	1,049,311 50	736	2,403,924	47,036,091
1913.....	1,361,964 06	820	2,690,535	63,345,788
1926.....	4,632,599 92	1,421	4,221,730	135,897,882
1927.....	5,453,951 56	1,610	4,992,486	195,247,914

MONTREAL, May 28, 1928.

Hon. Mr. McDUGALD: Would you state the relationship which exists between the present business and the existing facilities, that is to say, elevator facilities and berthing facilities?

Mr. HARVIE: In 1921 the grain business of the port increased very rapidly; as a matter of fact, 121 per cent in one year. That obliged the Commissioners in the following year or two to find some means of dealing with this enormous increase. Investigations were made, and as a result of those investigations the facilities were increased, the storage was increased, the berths were increased, and so on. The total capacity for grain handling was largely increased in those years. The large quantity which originated in 1921 was not only maintained, but went on increasing, and the grain facilities in the Port of Montreal have been kept ahead of the business, as a result of the investigation following the abnormal increase in 1921—by this constant expansion the elevator equipment is capable of the business it is getting now and probably will get for a few years to come, but no doubt in a few more years additional extensions will be necessary. Nevertheless, so far as the grain handling equipment is concerned, the Harbour Commissioners are in a comfortable position to-day.

Hon. Mr. REID: For what capacity of grain?

Mr. HARVIE: At the end of this year 15,000,000 bushels storage, 3,000,000 of which is in course of construction.

Hon. Mr. CASGRAIN: All your space is taken at present, is it not?

Mr. HARVIE: I am coming to that, sir. With regard to berthage, transit sheds and general accommodation, I regret to say that the Commissioners are not in such good shape. While every Commission that I have served under—and I have served under three—has been extremely optimistic regarding the growth of business in the Port of Montreal, not one of them has been able to forecast the growth as it really occurred. In 1909 the first great scheme of harbour extension was authorized. It was begun in 1910. That scheme was supposed to take care of the growth of twenty-five years, and it was supposed to be completed in 12 or 13 years. It was completed in 12 or 13 years; in fact, more than completed; but the margin of thirteen years had gone. As soon as that scheme was completed it was practically just what was necessary for the business of that time. Since that time successive Commissions, and particularly the present Commission, have struggled hard to try and over-estimate the future, but they have not succeeded yet, and the fact is that to-day we are in worse shape than we were in 1922, so far as berthage, etc. is concerned. The Harbour Commissioners have under consideration just now several schemes of development to provide additional berthing space and additional

transit sheds. The Harbour Commissioners are striving to provide possibly as many as three, four, five or six new sheds within a year's time, and probably a mile of wharf. But in spite of what I have said, which is in no spirit of criticism—in spite of what I have said, the Commissioners have always taken care of the business. No business has ever been turned away.

Hon. Mr. McDougald: Before you leave that, Mr. Harvie, would you just state the approximate amount of money that you have spent on improvements in the Harbour in the last six years, and state the number of sheds and wharfs that we were short this year, or, in other words, that we could have leased out to shipping companies if we had had them?

Mr. Harvie: Yes. I will have to trust a little to memory for that. I think the amount that has been spent, or nearly spent, since 1922 is approaching \$27,000,000. There were, I think, three loans, \$10,000,000, \$5,000,000 and \$12,000,000. The \$10,000,000 and \$5,000,000 have long since gone, and a great deal of the \$12,000,000 has gone. Two sheds were built, many new wharves have been built, and various other facilities have been provided, but this season at the opening of navigation there were applications for, I think, four more sheds than we actually had. Nobody was turned away, but the shipping companies had to do with a lesser number of sheds and to use them more.

Hon. Mr. McLennan: Was there any serious delay to the steamers?

Mr. Harvie: Oh, no. It simply means the shipping companies probably had to—

Hon. Mr. Casgrain: Work night and day?

Mr. Harvie: Not so much that as probably crowd more into a shed than usual. But that is the situation. The same applies to wharves. We are certainly needing more wharves, and we are needing them badly, and we must have them. We hope to have them by next year. As soon as we get them we can rent them, but I would like to emphasize the fact that no business has been turned away, though the Commissioners have been very hard put to it.

Hon. Mr. Casgrain: You do not owe the Government anything for interest?

Mr. Harvie: No.

Hon. Mr. Casgrain: You pay interest, every cent?

Mr. Harvie: The Harbour Commissioners have always met their obligations and paid their interest.

Hon. Mr. McDougald: And sinking fund?

Mr. Harvie: And sinking fund and depreciation.

Hon. Mr. McLennan: Since what date? When did they begin to pay interest?

Mr. Harvie: As far as I know, they always did, sir.

Hon. Mr. McLennan: They have always done so?

Mr. Harvie: Long before my time, and I think they always did before that, too.

Hon. Mr. McDougald: If I may interject a remark on that, the point that I would like particularly to bring out is that, notwithstanding the fact that we have been spending vast sums of money—\$27,000,000 in the last six years—trying to provide facilities at the Port of Montreal, the business has increased so rapidly that we could not anticipate what the requirements would be, and this year we are confronted with almost exactly the same situation as we had six years ago. What I want to point out is that that is only indicative of what will happen in the St. Lawrence. If it happens at Montreal, the same condition will apply to the St. Lawrence, as regards facilities there.

Has there ever been an exhaustive study of the transportation conditions affecting the movement of traffic into the Harbour of Montreal?

Mr. HARVIE: Arising out of the increase in the grain exports in the year I have referred to, 1921, the Commissioners arrived at their plan of expansion by following the recommendations of a Committee appointed to advise them. It was called the Grain Elevators Committee. This Committee was appointed on the 29th of March, 1922, and the function of the Committee was to explore the whole question of transportation and handling, particularly of grain, from the head of the lakes to the seaboard. They made a very exhaustive study and submitted a very able and very detailed report. In the report were certain recommendations, which I can read if you care to hear them.

The CHAIRMAN: Yes.

Mr. HARVIE (reading): The Committee has come to the following conclusions and makes the undermentioned recommendations in regard thereto:

(1) The maximum use of the elevator facilities in the movement of export grain can only be obtained by means of the closest co-operation between the various agencies involved in the transportation of grain between the head of the Lakes and Canadian ports of export.

The best means of bringing about this co-operation is a matter which should be worked out by the various interests.

(2) The control, construction and operation of the elevator facilities at the Port of Montreal should be vested in one authority in the interests of the development of the grain movement through that port.

The Committee recommend that this be done.

(3) During the seasons 1921 and 1922 additional storage capacity of 2,900,000 bushels would have been necessary to have completely relieved the congestion at Montreal and four or five additional berths were required for the proper accommodation of tramps.

The Committee recommend that the storage facilities at Montreal be at once increased by 3,000,000 bushels in the expectation of the present volume of grain being maintained. In the event of the present volume of grain being appreciably increased, a further extension of 2,500,000 bushels would be justified. The Committee further recommend that four or five additional berths be provided for the accommodation of tramps.

(4) The present accommodation available for liners in the central portion of the Harbour of Montreal is not sufficient to meet the requirements and additional accommodation is needed.

The Committee recommend that additional accommodation for liners be provided from time to time as business warrants.

(5) Additional storage to the extent of 3,500,000 bushels would have been required at Port Colborne to have completely relieved the congestion at that point during the seasons of 1921 and 1922.

The Committee, however, recommends the immediate extension of the present facilities by 2,000,000 bushels additional storage capacity, feeling that under the improved conditions which are likely to exist following the extension of facilities at other points and the closer co-operation between the various interests involved the present situation will be greatly relieved by this additional storage.

(6) Additional storage to the extent of 3,000,000 bushels would have been required at the Bay Ports to have taken care of the movement of grain through these ports during the seasons 1921 and 1922.

The additional storage of 3,000,000 bushels, however, would not have been sufficient to have taken care of any additional movement, but would merely have

relieved the congestion which existed during these two seasons. To provide for a large increase in the movement through the Bay Ports than that which took place in the two seasons referred to, storage capacity in excess of 3,000,000 bushels would be required. The Committee, however, feel that the provision of additional storage facilities at the Bay Ports might very well be left to the initiative of the interests at present in control of the elevator facilities at these points.

(7) Owing to difficulties experienced in establishing trade connections at Quebec, the elevator facilities at that point have not, in the past, been fully utilized.

The Committee recommend that the various interests involved in the transportation of grain co-operate to as great an extent as possible to make greater use of the excellent facilities provided at that point.

(8) The flexibility of the elevator capacity during the rush season is governed to a large extent by the free storage period.

The Committee recommend that a reduction in the free storage period at the Lake and Bay Ports be given very serious consideration.

(Signed) C. J. SMITH,

" R. A. C. HENRY,

" M. P. FENNELL, Chairman.

Hon. Mr. CASGRAIN: Name those Bay Ports, for those who may not know them.

Mr. HARVIE: Ports McNicoll, Tiffin, Midland, and—would you call Depot Harbour a bay port?

Hon. Mr. CASGRAIN: Parry Sound?

Mr. HARVIE: Parry Sound and Depot Harbour.

Hon. Mr. ROBERTSON: Mr. Harvie, you have emphasized four or five times during your evidence the apparently abnormal increase in grain handled through the port of Montreal in the year 1921-1922. I do not recall that there was any exceptional crop that year. Could you tell us what was the reason for that large increase?

Mr. HARVIE: That probably would be only my opinion, but I think it was simply due to the general recuperation after the war in Europe and the big demand for grain. Europe was half starved, and fortunately there was a big crop and everything fitted in.

Hon. Mr. ROBERTSON: Was there a large shipment of American grain started about that time?

Mr. HARVIE: I think so—or the year after. I am not sure which. I think it was simply that the demand from Europe coincided with a good crop.

Hon. Mr. ROBERTSON: I could not recall that we had any abnormal crop in that year.

Mr. HARVIE: I think it was a good crop. I do not really remember the amount, but I think the chief thing was the excessive demand in Europe for grain. I think the whole of Europe was more or less impoverished after the war, and so on, and European countries were beginning to recover. And I think perhaps the Argentine did not fill the bill so well that year.

Shall I file the statement?

Hon. Mr. McLENNAN: We have gone on from that increase in those years to a greater increase?

Mr. HARVIE: Oh, steadily. The grain deliveries last year were more than three times what they were in 1920.

Hon. Mr. L'ESPERANCE: The increase in Canadian grain was not large? Was that American grain, some of it?

Mr. HARVIE: Both.

Hon. Mr. L'ESPERANCE: Was the increase more pronounced in the American than in the Canadian grain?

Mr. HARVIE: Last year it was. Half the grain we exported last year was American grain—92½ million bushels, or something like that.

Hon. Mr. ROBERTSON: Is the total exportation of American grain to foreign countries increasing or otherwise?

Mr. HARVIE: It is increasing, sir. That is where it goes; it goes to foreign countries, that is to say, countries foreign to Canada. The United Kingdom and European ports.

Hon. Mr. ROBERTSON: Is the production of American grain increasing in comparison?

Mr. HARVIE: I am afraid I cannot tell you that for the moment.

Hon. Mr. ROBERTSON: What I had in mind was what the future holds in store so far as the continued expansion of grain export is concerned; my understanding is that the United States is exporting annually a smaller amount, due to larger home consumption, and I was wondering whether this expansion in the last ten or fifteen years is likely to continue indefinitely.

Mr. HARVIE: What I had meant is that the export of American grain through the port of Montreal is increasing very greatly.

Hon. Mr. WILLOUGHBY: Are you looking for an increasing export through the port of Montreal of our own Canadian grain?

Mr. HARVIE: Yes, it is increasing.

Hon. Mr. L'ESPERANCE: The Panama Canal does not really stop that increase?

Mr. HARVIE: No, and so far as Vancouver is concerned, compared with Montreal, they are both growing at the same time. As far as I can see Vancouver does not affect us at all.

Hon. Mr. CASGRAIN: What about Hudson Bay; will that take much?

Mr. HARVIE: I have never been to Hudson Bay.

Hon. Mr. GILLIS: You will find out in the course of a year or two.

Hon. Mr. McDougald: Have the recommendations of that Committee been put into effect? While we are waiting, Mr. Chairman, I think it would be well to put this report on record. I think it is the most voluminous report I have seen, and it is very well prepared, and probably some members of the Committee would like to just glance through it. It will give some idea of the work that has been put on this scheme.

Hon. Mr. GILLIS: Is that in connection with Montreal harbour?

Hon. Mr. McDougald: The Minister of Railways and Canals and the Minister of Marine and Fisheries, when we were trying to determine what should be done in order to facilitate the handling of grain at Montreal, suggested that we should have all the interests investigate and make a report on it, and this is the result of that investigation. Just at this point I would like to say that Mr. R. A. C. Henry was the man who did most of the work on that report. That is why I would like especially to have him called before the Committee.

The CHAIRMAN: Of course all these documents will be in the possession of the secretary, Mr. Hinds, and will be available to any members of the Committee.

Hon. Mr. MURPHY: This is the report from which Mr. Harvie has been quoting?

Hon. Mr. McDougald: Yes. Do you think the improvement and deepening of the St. Lawrence River would increase or decrease the business through the port of Montreal?

Mr. Harvie: Might I suggest that I tell the Committee just how far those recommendations were carried out? I really forgot to do that. Those recommendations in regard to the port of Montreal, made by the Grain Elevator Committee, consisted of adding, immediately, 3,000,000 bushels additional storage, and perhaps very soon another 2,500,000. It also recommended the equipping of four or five additional berths for tramps. It recommended, in the first case, one control of all the harbour facilities in the port of Montreal. These, briefly, were the recommendations for the port of Montreal. Those recommendations were followed by the Harbour Commissioners immediately, and are still being followed. Elevator "B" was immediately extended, an additional storage of 1,250,000 bushels being made. A new elevator at the Tarte pier, elevator No. 3, was constructed, making a total of around 3,000,000 bushels additional. Just now, at this new elevator at the Tarte pier another 3,000,000 is in course of construction. This elevator at the Tarte pier was designed so that the first unit of 2,000,000 would simply be a unit of a house that might eventually, as business grew, become 10,000,000 or 12,000,000. So the first unit of elevator No. 3 was built. Then there is being added now what will give the 2,500,000, which they suggested would very soon be needed, and as time goes on another 3,000,000 and another 3,000,000 may be added to that house; so that as far as storage is concerned the Commissioners absolutely followed to the letter those recommendations. With regard to the additional berths for tramps, four additional berths were equipped at Elevator "B"; a new jetty with two berths was provided at elevator No. 2, and five additional berths were provided at the Tarte pier. Of these five, four are equipped with transit sheds and are really liner berths, so that again the recommendation of the Committee has been rather better than followed in that case.

Hon. Mr. Reid: Is your elevator capacity sufficient to store grain at the close of navigation, winter storage?

Mr. Harvie: We can store 15,000,000 bushels.

Hon. Mr. Reid: Is there more than that storage called for at the end of the season?

Mr. Harvie: This last year there was not.

Hon. Mr. Gillis: Have you anything to show the comparison of Canadian grain shipped through Vancouver with what was shipped through Montreal?

Mr. Harvie: I have not the figures of Vancouver here. I can get them for you if you like.

Hon. Mr. Casgrain: Between 60,000,000 and 70,000,000 by Vancouver, and here 195,000,000—about one-third.

Hon. Mr. McDougald: From Vancouver it is all Canadian grain, while 50 per cent of the grain through Montreal is American grain. Of course that is easily explained. The St. Lawrence is practically open only for 7 months, while Vancouver is open all the year around.

Hon. Mr. McLennan: The American grain comes before we get our own crops.

Hon. Mr. McDougald: Yes, it is earlier.

Mr. Harvie: I should have stated that the first recommendation of that Committee, namely, that the elevator system of Montreal should be under control of the Harbour Commissioners, was immediately given effect also. The Harbour Commissioners acquired the elevator at that time, which was formerly the property of, and operated by the Montreal Warehousing Company. The

whole elevator system since that time is under the exclusive control of the Harbour Commission.

Hon. Mr. McLENNAN: Are the Canadian National elevators now under your control?

Mr. HARVIE: Absolutely.

Hon. Mr. McDUGALD: That was the old elevator "B." Mr. Harvie do you think the improvement and deepening of the St. Lawrence river would increase or decrease the business through the port of Montreal?

Mr. HARVIE: I think the deepening of the St. Lawrence channel, the St. Lawrence river, would increase the business, because the improved channel would then mean bigger ships, and therefore cheaper transportation.

Hon. Mr. L'ESPÉRANCE: From the head of the lakes?

Mr. HARVIE: Both ways; both below and above. The size of ocean vessels coming to the port of Montreal is steadily increasing, there being at the present time passenger liners of 19,000 tons gross register, to be followed, I believe, by others of 20,000 tons register; in addition to that, there are freighters capable of carrying from 12,000 to 14,000 tons of cargo.

Hon. Mr. McLENNAN: What is the dead weight of the 19,000 to 20,000 ton register boats?

Mr. HARVIE: That would be a rather difficult thing to tell. I do not know. They do not go by displacement at all in those boats; it is gross and net register.

Hon. Mr. CASGRAIN: Is that dead weight tonnage, the one you have just stated there?

Mr. HARVIE: That one is, the 12,000 to 14,000 tons, but the 19,000 tons is gross register. Those are passenger liners.

Hon. Mr. McLENNAN: Much of that is not available for cargo.

Mr. HARVIE: At all events, the limits in the size of vessels coming to the port of Montreal are governed by limitations of the channel. The channel is needing to be deeper. It is being made deeper now, 5 feet deeper, and eventually will have to be made deeper again, whether by dredging or otherwise. That, again, applies to the channel above, in my opinion; it is a natural corollary. At all events, the deepening of the ship channel followed an improved inland waterway, but the improvement of the channel below Quebec has gone on steadily, whereas the channel above Montreal has not.

Hon. Mr. McDUGALD: The channel below Montreal?

Mr. HARVIE: The channel below Montreal has gone on steadily, whereas the channel above has been stationary since 1875.

Hon. Mr. CASGRAIN: This Soulanges canal was since that?

Mr. HARVIE: I am thinking of the Lachine canal, which is the factor governing Montreal.

Hon. Mr. L'ESPÉRANCE: It is the weak link.

Hon. Mr. CASGRAIN: The Soulanges canal was only finished in 1896 or 1897.

Mr. HARVIE: The figure I was giving was for the Lachine canal.

Hon. Mr. L'ESPÉRANCE: The chain is only as good as the weakest link, and the weakest link was the Soulanges canal, and they made it deeper.

Hon. Mr. REID: Do you think the larger sized vessels would go through the upper lakes?

Mr. HARVIE: No, I do not think any vessel of any considerable size would go up to the upper lakes. There might be a coaster, or something, an odd one.

Hon. Mr. REID: You think they would tranship at Montreal?

Mr. HARVIE: Yes. I think, for the reason, that the increasing of any channel reduces the cost of transportation. The greater the ship the more bulk is carried, and obviously it must be cheaper. From that point of view I think anything that tends to cheapen will increase the business. Nor do I understand that it is possible to contemplate an improvement of the channel above Montreal without a power development. If there is a power development—and I presume the power development is what will really build the canal—with plenty of cheap power and all that sort of thing, within a reasonable range of the port of Montreal, you should have large steamers bringing in bulk cargoes of raw materials or something. Cheap power would undoubtedly, I should think, establish industries and factories close to that power. With the power development there will be cheaper transportation, and as far as I can see the development ought to increase the business inevitably.

Hon. Mr. REID: Your argument is that the vessels will not go west of Montreal?

Mr. HARVIE: The ocean vessels?

Hon. Mr. REID: But they will all be transferred at Montreal?

Mr. HARVIE: Yes.

Hon. Mr. McDUGALD: Why? Give reasons for your answer.

Mr. HARVIE: I have them here.

Hon. Mr. McDUGALD: If the Chairman will allow me to go on, I had that question for Mr. Harvie, and I think it will facilitate matters to take them in order: At the present time have there been any recent developments which have come to your attention which would indicate a greater movement through the port of Montreal, either import or export?

Mr. HARVIE: There are many indications. I have already mentioned one—that this year the new lines coming to the port required more sheds than we had. That has been constantly happening during the last few years; new lines are coming in, and new lines mean new business.

Hon. Mr. McLENNAN: Is that to handle mostly articles?

Mr. HARVIE: No, both.

Hon. Mr. McLENNAN: Package freight?

Mr. HARVIE: Yes. There are new lines of business. Not only that, but the present lines of business; the grain business is obviously increasing all the time; there does not seem to be any apparent limit to that. Then the importation of coal, as I have already shown you gentlemen, is steadily increasing. The whole business of the port is steadily increasing, but over and above all that we have succeeded in attracting to the port of Montreal, within the last two years, a business that formerly went to Baltimore—the importation of Norwegian wood pulp for the United States. I believe the Harbour Commission will handle 100,000 tons of that this season; I am perfectly certain of about 90,000. Another thing is that I do know that negotiations are under way for the establishment of a large importation of potash—another bulk product.

Hon. Mr. CASGRAIN: From Germany?

Mr. HARVIE: I think it is; but, at all events, that line of business is imminent; in fact, it is possibly accomplished by now.

Hon. Mr. McDUGALD: It is dangerous to give figures sometimes, because we are in competition, but the business offering is so important and so large that it would be enough for any one harbour to handle alone, almost, and that is presently going through United States channels. To make it perfectly clear, so that there will be no misunderstanding in the country or among the paper people,

the wood pulp that Mr. Harvie speaks of goes through to the United States; it does not interfere with our business at all.

Hon. Mr. McLENNAN: Transhipped at Montreal?

Hon. Mr. McDUGALD: It is transhipped into lake boats, and they come to Montreal because they get cheaper rates from Montreal beyond, to Chicago and western points.

Hon. Mr. McLENNAN: Where is that used?

Hon. Mr. McDUGALD: Chicago and Detroit, and that section. That business is at present coming through Baltimore and Philadelphia.

Hon. Mr. SMITH: If the St. Lawrence channel were deepened would those Norwegian boats go right through?

Mr. HARVIE: I doubt it. I think, however, this is a very good illustration of what I think will happen. This pulp wood has been going for years to Baltimore, I forget how many millions of tons. It goes to Baltimore because the rate there is so cheap for the ocean boat that they can take it to the middle west by rail, but enterprising people, assisted by the Harbour Commissioners, have succeeded in getting better rates to Montreal. But to get those better rates, it must come in large ships. You cannot bring bulk stuff across the ocean in small ships with any economy. It must come in large ships, and it would not be economy to take the large ship, even if it could go up the waterway. It is now transferred into the biggest lake boats they can find, and the bigger the lake boats that can go through, the cheaper will the transportation rate be, and that will be the idea.

Hon. Mr. CASGRAIN: That will make an economical cargo?

Mr. HARVIE: Yes.

Hon. Mr. GILLIS: It is purely a question of size that prevents the boats going up to the lake ports?

Mr. HARVIE: No, not in my opinion.

Hon. Mr. L'ESPERANCE: The ocean boat is not built like the lake boats.

Mr. HARVIE: The ocean boat is an expensive thing. It is built strong; it is built to stand all the storms in the ocean.

Hon. Mr. L'ESPERANCE: And it requires a larger crew.

Mr. HARVIE: It is equipped to use salt water, with most expensive machinery. It is full of derricks to load and unload at any foreign port it may go to, and everything of that sort. It is full of men; those big boats that come to Montreal have hundreds of men.

Hon. Mr. CASGRAIN: What proportion will an ocean carrier bear to a laker?

Mr. HARVIE: I am not very sure of that, but I would not be surprised if it was around 50 per cent, but I would really like to check that up.

Hon. Mr. GILLIS: What you have outlined does not go to prove that it would be impossible for them to navigate by the route up to the head of the lakes.

Mr. HARVIE: I have not said anything about that. I think that so far as operating is concerned, they could not afford to do it. But in addition to that, the construction of the ocean steamer is utterly different in elevation, you might say, as compared with the ordinary lake boat. The lake boat has a low freeboard; the ocean steamers have a very high freeboard. There are various points of construction like that. For example, in my opinion it would be very awkward for one of those big high liners in Montreal, or one of those big high freighters, with high decks, being caught by winds on approaching a lock.

Hon. Mr. L'ESPERANCE: It would be economically unsound.

Mr. HARVIE: I think so, sir.

Hon. Mr. McDUGALD: There is another point about getting cargo at Montreal; I think that is important to explain to the Committee.

Mr. HARVIE: I have already mentioned the size of the big freighters. Freighters are not necessarily tramps; they may be liners, although not passenger liners. Those are fellows carrying 12,000 to 14,000 tons. Then there are the liners I have spoken of with 20,000 tons gross register, but you have big tramps, and some tramps are as big as the freight liners and as big as some passenger liners. Now, a tramp like that can come into the port of Montreal, and we have a record for loading a tramp like that, and the record was 276,000 bushels in 6½ hours. A boat like that can come in and fit out and get all its stores, and everything that is wanted, and have a full cargo, and go right away. Including the fitting out and all those things I referred to a minute ago, I think the total time was 36 hours, including everything from the time she came in to the time she sailed, but the loading of grain was 6½ hours for 276,000 bushels. That was a tramp.

Hon. Mr. McLENNAN: What was the tonnage of the tramp?

Mr. HARVIE: About 8,000 to 10,000 tons capacity, I think.

A still more important thing about the Port of Montreal is that there are not many ships that take a straight cargo of one grade of grain. I have seen forty orders for one ship, all of different kinds of grain, not only Canadian grain, but different kinds of American grain. It is not necessarily Canadian grain; sometimes it is American grain that is in demand, sometimes vice versa. The Port of Montreal is somewhat like a large departmental store in that the ship can get anything it wants. I do not know how these fellows sell grain, but I know they change their minds half an hour before they commence loading the ship, and change to something else. If the ocean ships have to be served in that respect, we must have a big assortment of almost every kind of grain.

Hon. Mr. CASGRAIN: It is not ear-marked. You must have a clearing house.

Hon. Mr. McLENNAN: Does much corn come to Montreal now?

Mr. HARVIE: Not so much. One year it almost disappeared altogether. I think that was in 1923 or 1924.

Hon. Mr. McLENNAN: Is not what you say about the prospective improvement in the St. Lawrence borne out by all the ports of commerce in Europe and South America that have made improvements—that they have found business increase?

Mr. HARVIE: I think so. Of course it must be an economic route, of which the St. Lawrence is an outstanding example.

Hon. Mr. McDUGALD: Take the Manchester Ship Canal, for instance.

Mr. HARVIE: I happen to know something about the Manchester Ship Canal. It was regarded as sheer lunacy by some people when it was built. It was claimed that it would take the business away from Liverpool, but Liverpool has gone on increasing its trade. A special ship is required for the canal.

Hon. Mr. McDUGALD: From your knowledge of shipping through the Port of Montreal, what fraction of competition tends to divert traffic from that port?

Mr. HARVIE: I think I referred to that before. The competition in the transportation of grain from the head of the Lakes to Europe is so keen that a cut of from one-eighth to one-quarter of a cent is quite enough to cause the port of Montreal to lose business to the more southern Atlantic ports. Yesterday I was told by one of the most prominent grain men in Montreal that that morning Montreal had lost a fair quantity of oats to Baltimore because the Montreal rate was one-eighth of a cent more than the Baltimore rate; and I know that a short time ago the Canadian National Railway lost a considerable amount of business at Depot Harbour, which they were trying to get, because the rate through Depot Harbour, because of some question of insurance, was between one-eighth and one-quarter of a cent more than the other way.

Hon. Mr. CASGRAIN: Were they Canadian oats?

Mr. HARVIE: Going from Fort William.

Hon. Mr. CASGRAIN: Where did they go? To Buffalo?

Mr. HARVIE: I think so.

Hon. Mr. CASGRAIN: And then by rail from Buffalo?

Mr. HARVIE: I think so. I am not quite sure of that.

Right Hon. Mr. GRAHAM. In your opinion, with all your experience in transportation matters, which has been very wide, and in connection with the Port of Montreal, it is your studied judgment that the improvement of the St. Lawrence would not only not injure the Port of Montreal but would be of benefit to it?

Mr. HARVIE: It is, sir.

Hon. Mr. McDUGALD: In your opinion, if the St. Lawrence waterways are deepened as suggested by the National Advisory Committee, will ocean shipping, as has been suggested by some writers, pass the Port of Montreal and go to the Great Lakes? I think you have already answered that.

Mr. HARVIE: I should like to add to that if I may. In my opinion Montreal will always remain the head of ocean navigation. I should like to point out one or two reasons why I think so. Montreal, although it is a thousand miles up the great St. Lawrence route, the most economic route on this continent, is at least as close, and I think closer to Europe than its most formidable rival, the port of New York. That governs the distance the ocean ship must go. I have been told by experienced shipping men that a ship is only making money when it is going at a fair speed with a fair cargo. The moment it is lying at a dock or is delayed for any cause whatsoever, it is losing money. Any trading ship will go to the nearest competitive port where it will get the shortest turn around. There is no port in the world where you will get as short a turn round as at Montreal, and the competitive distance with its biggest rival, New York, is favourable.

Hon. Mr. CASGRAIN: It is over 300 miles shorter.

Mr. HARVIE: I was also going to refer to the report of the Commissioners of 1920.

Hon. Mr. McDUGALD: I put that on record.

Mr. HARVIE: I would like to say that I have had to do with the building of the port of Montreal in one capacity or another for twenty years, and the officers I have worked under and with, and the Commissioners I have served under, as far as I have been able to judge, always anticipated a deeper waterway, and I would say that the report of 1920 bears that out. I know that the marine tower jetty of elevator 3 was designed to handle any sized lake boat; and anything that was done in the harbour that had any bearing on that—it probably was not a concrete fact, but as far as I know everybody considered it an inevitable development following on the deepening of the ship channel.

Hon. Mr. McDUGALD: In effect, the National Advisory Committee recommend that the improvements of the International Section and the improvements of the Quebec Section shall be done without expense to the Dominion Government, and consequently without expense to navigation, other than that involved in the maintenance and operation of the improved canal after completion. If this policy is carried out do you think the movement of freight through the improved canals would be appreciably increased?

Mr. HARVIE: Yes, sir. I think I have already given the reasons.

Hon. Mr. REID: Would the same thing happen if the canal was built on the Canadian side on the same terms?

Mr. HARVIE: So long as the canal is there to put ships through, that is all I care for Montreal.

Hon. Mr. McDougald: Do you think that the lake shipping interests would take advantage of the increased size of facilities provided?

Mr. Harvie: I think undoubtedly they would. The size of the ship coming to any point is merely governed by the access. The size of the ship coming to Montreal is governed in that way, and if the canal is built, the ships coming from the lakes will be governed that way.

Alex. Ferguson, Assistant General Manager of the Harbour Commission of Montreal, was called as a witness.

Hon. Mr. McDougald: What is your experience in transportation, Mr. Ferguson?

Mr. Ferguson: I will just read the statement that I have, sir, if I may.

January, 1906, to December, 1909, Locating Engineer on the National Transcontinental Railway. January, 1910 to August, 1914, Division Engineer in charge of construction, National Transcontinental Railway. August, 1914, to January, 1917, Inspecting Engineer, Department of Railways and Canals, in charge of inspection of railways constructed under Dominion Government subsidy and bond guarantee. January, 1917, to April, 1917, Advising and reporting to the Royal Commission of Inquiry into Railways and Transportation (Drayton-Ackworth Commission) in connection with the valuation of Canadian Northern Lines. May, 1917, to January, 1918, in charge of consolidation of 200 miles of Canadian Northern and Grand Trunk Pacific Lines through the Yellowhead Pass, carried out in order to release rails for the use of the armies in France. February, 1918, to May, 1918, on Board of Engineers associated with counsel in charge of preparation and presentation of Government case in the Canadian Northern stock arbitration. May, 1918, to June, 1927, General Assistant Engineer, Department of Railways and Canals. June, 1918, to December, 1919, Investigating and adjusting claims for compensation resulting from consolidation of lines in the Yellowhead Pass. Investigating causes of and reporting on remedies for shrinkage in the production of nickel for war purposes. Investigating physical condition of branch lines in Eastern Canada. Analyzing economic disposition of lines through the Yellowhead Pass. January, 1920, to May, 1920, investigating the physical financial and economic conditions of the Edmonton, Dunvegan and British Columbia Railway and the Central Railway of Canada. June, 1920, to February, 1924, Acting Assistant Chief Engineer, Dominion Highways Commission. During 1923 investigated physical, financial and economic condition of the Inverness Railway and Coal Company. February, 1924, to June, 1927, in charge of Port Colborne Government Grain Elevator, reorganizing and establishing improved operating conditions and regulations. June, 1927, to date, Assistant General Manager, Montreal Harbour Commission.

Hon. Mr. McDougald: In your capacity as Superintendent of the Government elevator did you study the movement of grain and other commodities through the canal system?

Mr. Ferguson: When I was in charge of that elevator it was necessary to study the movement of grain through the canal system. Other commodities did not play such an important part, so I was not so familiar with them.

Hon. Mr. McDougald: Did you, as a result of your study, come to any conclusions as to the influence of the St. Lawrence waterway upon the movement of grain from the Central West to the seaboard?

Mr. Ferguson: Yes. I came to the conclusion that the water route from the head of the lakes to the sea was the most effective route in the transportation of grain from that portion of the Canadian West, east of the Saskatchewan-British Columbia boundary to Europe, and that therefore it is the controlling

factor in the cost of transportation to the world market of Canadian surplus grain.

Hon. Mr. McDougald: In your studies of this situation at Port Colborne did you observe any physical obstacles which tended to prevent a larger movement of grain through the canal system below Port Colborne?

Mr. Ferguson: Yes, at certain periods. During the last two or three years the construction of the Welland Ship Canal has necessitated the use of craft in the Welland Canal, and the addition of that craft working on construction has, at times of peak flow, caused a condition of rather serious congestion; so much so that the time of traffic vessels passing through the canal has practically doubled, or so, during my time. That came very forcibly to my attention because it was of extreme importance that I should know, as officer in charge of the elevator, the movements of all vessels coming from both ends.

Hon. Mr. Casgrain: How long does it take a vessel to go from Port Colborne to Montreal—a small vessel, 14 feet only?

Mr. Ferguson: Three days.

Hon. Mr. L'Esperance: What is the distance?

Mr. Ferguson: The distance is roughly 300 miles.

Hon. Mr. L'Esperance: One hundred miles a day.

Hon. Mr. Casgrain: Would a bigger vessel make it any faster?

Mr. Ferguson: I would not say so.

Hon. Mr. L'Esperance: Could a bigger vessel go through?

Mr. Ferguson: Now, there is another difficulty in the movement of grain through Canadian channels, and that is the inability at periods of peak flow for the elevator facilities at Port Colborne to take care of the grain that offers there.

Hon. Mr. Casgrain: When you talk of the periods you might mention what time of the year.

Mr. Ferguson: Usually the spring and the fall.

Hon. Mr. Casgrain: You are dull during July and August?

Mr. Ferguson: July and August it is usually quite dull.

Hon. Mr. Casgrain: And the latter part of June?

Mr. Ferguson: Yes. But during the spring flow and the fall, after the Canadian crop comes in—that is when the surplus is first released from the head of the lakes—there is always a big rush of grain. A great many vessels lie at the head of the lakes with storage cargoes all winter, and as soon as navigation opens those boats start down. They go to all ports, but principally Buffalo and Port Colborne. Now, when that surplus is shipped out, then the grain trade on the lakes falls off. The next movement is usually that of the American crop, which comes in before the Canadian crop.

Hon. Mr. Casgrain: About how long before?

Mr. Ferguson: Oh, about a month before. That comes in about the beginning of August. The Canadian crop then comes in, from the beginning to the end of September. I have seen the first Canadian grain getting in as early as the 10th to the 15th of September.

Hon. Mr. McLennan: Getting down to Port Colborne by that time?

Mr. Ferguson: Yes. But usually it is later than that. Around the end of September the Canadian crop gets into Fort William, and of course it moves on rapidly from there.

Now, that causes congestion at Port Colborne. Those large vessels coming in and bringing more cargo than the elevator can unload quickly, they pile up and have to wait. That is an obstruction through the Canadian channel.

Hon. Mr. Reid: They go to Buffalo, a lot of them.

Mr. FERGUSON: They go to Buffalo.

Hon. Mr. REID: And transfer then to Montreal?

Mr. FERGUSON: And then a great deal of it goes from Buffalo to Montreal.

Hon. Mr. CASGRAIN: That is how they evade the law.

Mr. FERGUSON: Unquestionably. Of course some of that grain when it reaches Buffalo may go on to the American Atlantic seaboard.

Hon. Mr. CASGRAIN: Some of it?

Mr. FERGUSON: How much I could not say.

Hon. Mr. McLENNAN: But there is congestion at Buffalo too, at times, is there not?

Mr. FERGUSON: Yes, but from my observation, not so often as at Port Colborne. Last year there was a very serious congestion at Buffalo, which lasted for a considerable time.

Hon. Mr. McDUGALD: If I recall, Mr. Ferguson, you told me one day that in one week while you were at Port Colborne you had to refuse 4,000,000 bushels of grain offered, because of lack of facilities there.

Mr. FERGUSON: In the period of a month. That was the first month of navigation, 1926.

Hon. Mr. CASGRAIN: Was that when they passed an Order in Council to allow the American ships to come in? Did that cause the congestion?

Mr. FERGUSON: No, sir.

Hon. Mr. CASGRAIN: When was that?

Mr. FERGUSON: It was simply because there was so much grain coming to Port Colborne that we could not possibly handle it.

Hon. Mr. CASGRAIN: You are aware that at one time the Government passed an Order in Council to allow American vessels to take grain to Port Colborne from Fort William? Do you remember that, or do you know that?

Mr. FERGUSON: Oh, yes.

Hon. Mr. CASGRAIN: That is right.

Mr. FERGUSON: That is done every year.

Hon. Mr. CASGRAIN: Oh, no, not every year. It was not done last year.

Hon. Mr. GILLIS: Practically every year.

Hon. Mr. CASGRAIN: Not last year.

Mr. FERGUSON: The Order in Council permits loading of the last cargo, which is described as the storage cargo. The vessel is permitted to load at a Canadian port and proceed to a Canadian port and there unload its cargo; but that is the only cargo that it is permitted to unload at a Canadian port. That is coastal cargo. Now, last year the Order in Council, if I remember rightly, put the additional condition that a vessel could not unload until the following spring—the opening of navigation in the following year.

Hon. Mr. McDUGALD: You have stated to me upon several occasions that in your opinion, from various studies by yourself, that with the contemplated improvements in the St. Lawrence waterway there would be a saving of 3 cents a bushel on the average basis of rates at present obtaining. Would you please confirm that to this Committee?

Mr. FERGUSON: Yes. I have, on different occasions, attempted to analyze the water movement with the object of arriving at the probable saving in cost of carrying grain from the head of the lakes to Montreal in large lake vessels. The result of these studies indicates a saving of 3 cents in cost to the vessels. I have approached the problem in two ways—

Hon. Mr. SMITH: Would you explain that?

Mr. FERGUSON: Yes, I will in a moment. I have approached the problem in two ways: from the point of view of cost to the carrier and of existing rates. The results in both cases appear to agree. Now, I have here a statement based on cost of operation, which I can submit for your information.

Hon. Mr. McDUGALD: I would like to have that go on the record, Mr. Chairman, please.

Mr. FERGUSON: Perhaps I might explain it. The conditions governing the movement of grain are so involved that in order to arrive at any conclusion in a matter of this kind it is necessary to make certain assumptions; that is, from my point of view. You must put each operation on a similar basis. For that reason I have considered the operation of a large lake vessel of a type suitable for navigation in the upper lakes, and a type which is now operating in the upper lakes.

Hon. Mr. CASGRAIN: A laker.

Mr. FERGUSON: Not the biggest and not the smallest. I have taken for that a boat which carries about 370,000 bushels of cargo. On the lower lakes I have also taken a boat which will not carry the fullest capacity through the canals, but is approaching the fullest capacity: that is, a boat which will take about 85,000 bushels. I have also assumed that there is no delay and there is no return cargo, because the questions of delay in navigation of course affect the cost very seriously, and there might be serious delays in one year and very little delay in another year, so that the actual cost taken, for any one year would not be a true reflection of the average cost over a long period. For that reason I have assumed no delays and no return cargo.

Hon. Mr. McLENNAN: What about interest on the investment and depreciation?

Mr. FERGUSON: I have that.

Hon. Mr. McLENNAN: You include that?

Mr. FERGUSON: Yes. In my canal vessel I have assumed a boat of a gross tonnage of 1,900 tons, with a capacity of 3,000 tons, a keel length of 250 feet, a beam of 42 feet 4 inches, a depth of 20 feet 6 inches, and costing about \$220,000.

Hon. Mr. McLENNAN: That would be on the lower canals? Fourteen feet?

Mr. FERGUSON: That is the lower canal vessel. A boat of that size will carry, on a 14-foot draft, which is the present canal draft, 85,000 bushels.

Hon. Mr. CASGRAIN: That is right.

Mr. FERGUSON: The cost of operation, worked out per annum, including wages, food, stores, fitting out, fuel, hull insurance for the season of navigation, is \$54,000; running repairs, \$3,000 (although that is a variable item); interest six per cent on the cost of \$220,000, is \$13,200; depreciation, on an assumed life of 25 years and a salvage value at the end of that time of \$20,000, is, at 4 per cent—that is, a life of 25 years would give 4 per cent—\$8,000. The total cost per annum would be \$78,200. To that you have to add overhead. That, again, is a figure that must be assumed. It might vary with different companies very considerably. I have assumed 15 per cent, which on that cost is \$11,730, making a total annual cost of \$89,930.

Taking an average season of 230 days, that is, its earning life in a year, the cost per day of operating that vessel is \$391.

Hon. Mr. CASGRAIN: Per day?

Mr. FERGUSON: Per day.

Hon. Mr. CASGRAIN: For a canal boat?

Mr. FERGUSON: Yes.

Hon. Mr. L'ESPERANCE: Of 85,000 bushels?

Mr. FERGUSON: Of 85,000 bushels.

Hon. Mr. CASGRAIN: That is, for a canal boat, \$391 a day?

Mr. FERGUSON: Yes, \$391 a day, operating between Port Colborne and Montreal, carrying grain; no return cargo and no delays.

Taking the complete round trip at $8\frac{1}{2}$ days, at the rate of \$391, you have \$3,323. Adding loading and unloading charges, which amount to almost one cent—nine-tenths of a cent—\$765. That is, nine-tenths of a cent on 85,000 bushels gives a total cost for the round trip of \$4,088.

That gives a cost per bushel from Port Colborne to Montreal, necessary to cover bare expenses and interest on capital, at the rate of 6 per cent—4.81 cents.

Hon. Mr. CASGRAIN: Where did you get that price there of \$250,000?

Mr. FERGUSON: \$220,000.

Hon. Mr. CASGRAIN: Where did you get that price?

Mr. FERGUSON: I got that from a shipping man.

Hon. Mr. CASGRAIN: Which shipping man? It is very important to know, because I think you are too high on the price of the ship.

Mr. FERGUSON: Am I at liberty?

Hon. Mr. CASGRAIN: Certainly.

Mr. FERGUSON: I got that from Carter & Wood as the actual cost of their two vessels.

Hon. Mr. McDUGALD: That should be good enough.

Hon. Mr. GILLIS: That is a good enough basis to work on.

Hon. Mr. L'ESPERANCE: What is the tonnage?

Hon. Mr. CASGRAIN: I think, about 3,000.

Hon. Mr. POPE: Go on with your story.

Mr. FERGUSON: Such a vessel could load to 16 feet if the draft were available, and carry 100,000 bushels. Now in order to get comparisons, assuming that a boat of that size were operating between the head of the lakes and Port Colborne, say a load of 16 feet draft, she could carry 100,000 bushels. I am not quite positive of that, it might be a little more. In that case the round trip, without delays, would be eight days and the cost about the same; I have assumed it the same, although there would be a slight difference there because, loading deeper, she would naturally burn some more coal. Eight days at \$391 is \$3,128. To that you have to add the loading and unloading charges at Fort William and Port Colborne, \$5.20 per thousand bushels, comes to \$520; a total cost for the round trip of \$3,648, and that gives a cost per bushel of 3.65 cents.

Hon. Mr. McLENNAN: What was the former cost on the lower limit?

Mr. FERGUSON: 4.81 cents. The same vessel operating from the head of the lakes works out at 3.65. Using a typical moderately sized vessel of the type operating between Fort William and Port Colborne with a gross tonnage of 7,400 tons, capacity of 10,000 tons, a keel length of 530 feet, with beam 58 feet and depth 31 feet, costing in the vicinity of \$700,000, the wheat load on 20-foot draft would be 370,000 bushels.

Hon. Mr. CASGRAIN: How much do you say the vessel cost?

Mr. FERGUSON: \$700,000. Of course you must remember that those boats have to be built in Canada, and the costs are not comparable to those in Europe, because they cannot get in. The cost of operation, wages, food, fitting out,

stores, fuel, hull insurance, \$103,000 for the season. Running repairs, \$3,000. Now I have assumed there the same running repairs for an upper lake vessel as for a lower lake vessel. I have not any actual figures on averages for that, but the upper lake vessel does not cost so much to repair, on account of the fact that she has only one lock to go through, and the running repairs are less on that account. The other boat, operating through the canal, has 26 locks through the Welland, and I think some 25 down below. Taking interest at 6 per cent on \$700,000, that would be \$42,000; depreciation—25-year life—with salvage value of \$70,000 at the end of that time, \$630,000 at 4 per cent, \$25,200. That makes a total of \$173,200. Assuming the same rate for overhead expense of 15 per cent, \$25,800; making a total cost for the year of \$199,000. That gives a total average cost per day, in a season of 230 days, of \$865 per day. Now I ought to draw attention there to the fact that I have again assumed the same length of period of navigation, although on the upper lakes the navigation, I think, is about ten days longer than it is on the canals; but for comparative purposes I have assumed the same period. Operating between Fort William and Port Colborne, carrying grain, no return cargo and no delays, completing round trips in eight days at \$865, would be \$6,920. Add loading and unloading charges on 370,000 bushels at \$520 per thousand bushels would give \$1,924; making a total for the round trip of \$8,844. Therefore the cost per bushel from Fort William to Port Colborne, necessary to cover bare expenses and interest on capital at 6 per cent is 2.39 cents. The next calculation is, assuming the same large lake vessel operating between the head of the lakes and Montreal at 20 foot draft, with no delays and no return cargo, for that operation I have to assume a period of navigation. I have assumed as in the other cases, loading at Fort William one day; Fort William to Montreal $6\frac{1}{2}$ days; and I have allowed the extra half day over the present time of operation because of the possible longer time that a large vessel will take in the canal system; unloading at Montreal, one day, which is the same assumption as before; Montreal to Fort William, again, $6\frac{1}{2}$ days, which is half a day longer, gives a round trip of 15 days. The cost for the round trip, 15 days at \$856 per day, \$12,975. Loading and unloading charges on 370,000 bushels at \$7.10 per 1,000 bushels \$2,627; the total for the round trip is \$15,602. Those loading and unloading charges are based on the present elevator charges at Fort William, Port Colborne and Montreal. The estimated cost per bushel, Fort William to Montreal, necessary to cover bare expenses and interest on capital at 6 per cent, with no operating delays and no return cargo, works out at 4.22 cents.

Hon. Mr. McLENNAN: As against what?

Mr. FERGUSON: I will give you the summarization of this.

Hon. Mr. REID: Have you got the same kind of statement, say, between Fort William and Kingston, Brockville or Prescott, pending the completion of the canal?

Mr. FERGUSON: No, I have not.

Hon. Mr. REID: What I mean by that is that the Welland Canal will be finished, say, in another year, and we will have 5 or 6 or 7 years during which we will not have the deep canal, and I would like to see exactly what that cost would be. You can figure that out from your own statement some time, and probably send in a statement about that.

Mr. FERGUSON: That would take a little study also, but I can do that.

Hon. Mr. SMITH: I understand that what is meant is to find the cost of carrying grain to Prescott or Montreal if the deep waterway canal was built, with an upper laker carrying 500,000 bushels to Prescott; what it would cost to carry that grain from Prescott to Montreal, and for that boat coming back

empty, as compared with the present situation, with a canal boat carrying from Prescott down to Montreal and back again.

Mr. FERGUSON: Yes, that is what I understand Dr. Reid's question to be.

Hon. Mr. SMITH: That is, the entire difference between the cost of carrying grain with the deep waterway and the cost of carrying grain when the Welland canal is finished, the difference between the carrying of that grain to Prescott or Montreal in an upper laker and the cost of carrying it in another way.

Hon. Mr. McLENNAN: There is another thing. If the river was dammed at one of those islands there you could get a very considerable horse-power in electricity, and so modify the current in the river that a boat could make better speed, or a boat could go with the smaller engines. Have you considered that?

Hon. Mr. REID: There is just one statement there that is a mistake. He has given us what it would cost between Fort William and Montreal when the channel is 25 feet, but for the next six or seven years we will not have that 25 foot channel. I would like to have an estimate of what would be the freight from Prescott—or whatever the terminal point is—in the St. Lawrence as it is now, and also what it would be when the canal was completed. You understand that?

Mr. FERGUSON: Yes, I understand that.

Hon. Mr. REID: That statement he could get and hand in. I would like to see how much we are going to save for the next six or seven years on account of the new Welland canal letting the lake vessels come right down.

Hon. Mr. GILLIS: That figure was 4, what?

Mr. FERGUSON: 4.22 cents. Summarizing that, the comparative cost of carrying grain by upper lake and canal vessels; that is, assuming the present upper lake vessel as against a canal vessel carrying over the same route from the head of the lakes to Port Colborne; cost by canal vessel from Fort William to Port Colborne, 3.65 cents; cost by upper lake vessel from Fort William to Port Colborne, 2.39 cents; showing a difference in favour of the large vessel, 1.26 cents.

Hon. Mr. CASGRAIN: But does the small vessel go from Port Colborne to Fort William?

Mr. FERGUSON: Sometimes. I am only submitting that as a comparison, to show the difference between the operation of the two boats.

Hon. Mr. MURPHY: Were you in charge at Port Colborne when the explosion took place?

Mr. FERGUSON: No, sir; that was in 1919. I went there in 1924.

Hon. Mr. MURPHY: Can you tell whether that was during the busy or the flat season?

Mr. FERGUSON: The explosion occurred on the 11th of August, just before the beginning of the big rush of grain.

Hon. Mr. L'ESPERANCE: Have you finished that statement?

Mr. FERGUSON: The probable saving in cost of transporting grain from Fort William to Montreal in large lake freighters through an enlarged waterway would be as follows: Cost under present system, Fort William to Port Colborne by typical large lake freighter, 2.39 cents; Port Colborne to Montreal by typical canal freighter, 4.81 cents; total cost, 7.20 cents. Estimated cost, Fort William to Montreal by typical large lake freighter operating through an enlarged canal system at 20 foot draft, 4.22 cents; estimated saving 2.98 cents. That is practically 3 cents—minus $\frac{2}{100}$. Those are my figures as I have worked them out, and I have done that quite a number of times as a matter of interest.

Hon. Mr. CASGRAIN: You have no practical knowledge of navigation? You were never a mariner or never operated a ship?

Mr. FERGUSON: No, I never operated a ship.

Hon. Mr. McDUGALD: Is the captain of a ship capable of making a set of figures such as these?

Hon. Mr. CASGRAIN: Oh, no; there is no doubt about that.

Hon. Mr. REID: Will you make that other statement, Mr. Ferguson, when you get time?

Mr. FERGUSON: Yes, I will be pleased to do so.

Hon. Mr. McDUGALD: There are just two more questions.

Mr. FERGUSON: I would like to point out in that connection that if you were to take the operating cost of any boat for any period it would not agree with these costs. It could not, because there are delays and other factors, return cargoes, and so on. It is an assumption and an average.

Hon. Mr. McLENNAN: Might I ask Mr. Ferguson a question? Have you worked these out at all in connection with the figures which were given us by Mr. McLachlan? Have you compared them?

Mr. FERGUSON: I have not. This is worked out from information that I have picked up from time to time from the shipping interests and the people who are operating the boats. I submit it as such.

Hon. Mr. McDUGALD: When do you think the capacity of existing canals will be reached?

Mr. FERGUSON: The canal statistics, those published for 1927 by the Dominion Bureau of Statistics, contain a statement to the effect that under the present conditions of traffic and average cargoes the estimated ultimate theoretical capacity of the Cornwall canal is 9,000,000 tons, and of the Soulanges and Lachine canals 12,000,000 tons. As the total traffic, both through and way, in 1927 was 7,912,952 tons, the Lachine and Soulanges are up to 66 per cent of their capacity. When I first heard those figures, I plotted a time tonnage chart to get an idea of when the ultimate capacity would be reached. The projection into the future of the general average rate of increase in tonnage from 1920 to 1927 along a straight line, indicates 12,000,000 tons in 1935. I have the chart here, and can show it to you.

Hon. Mr. McDUGALD: Can we let that go on the record?

The CHAIRMAN: Yes, put it on the records; we want to get all the information we can.

(Chart filed—St. Lawrence Canal System; Graph showing tonnage through freight, east-bound and west-bound, 1903 to 1927).

Hon. Mr. McDUGALD: If necessary facilities are not provided at Montreal or on the St. Lawrence is there any danger of the proposed New York State Albany route diverting traffic?

Mr. FERGUSON: If necessary facilities are not provided at Montreal and on the St. Lawrence within measurable time, a choke will occur at Lake Ontario, and the surplus, unable to come through the St. Lawrence system, will overflow into other routes. It is difficult, at this stage, to say what those routes will be, but it is certain that the U.S. will make a strong bid for the business. The other routes might be, rail from Kingston or Prescott to Montreal, rail from Ogdensburg to New York or Albany, water from Oswego to New York or Albany, and water from Buffalo to New York or Albany. Those are, as I see it, the alternative routes.

Hon. Mr. McDUGALD: In effect the National Advisory Committee recommends that the improvements of the International Section and the improvements

of the Quebec section shall be done without expense to the Dominion Government and consequently without expense to navigation, other than that involved in the maintenance and operation of the improved canal after completion. If this policy is carried out do you think the movement of freight through the improved canals would be appreciably increased?

Mr. FERGUSON: The enlargement of the canal system will unquestionably increase the business flowing through it.

Hon. Mr. McDougald: Do you think that the lake shipping interests would take advantage of the increased size of the facilities provided?

Mr. FERGUSON: My answer to that is that the vessels at present using the canal system are designed so closely that there is only a few inches to spare on each side of the lock, and perhaps a couple of feet in the length; and if the locks were widened to-morrow a foot, deepened a foot, and lengthened twenty feet, the next boat built would be a foot wider and 20 feet longer, and would be loaded one foot deeper, and I think if the locks were then widened 5 feet and lengthened 50 or 100 feet that the next vessels would be increased by those amounts, and if they were deepened they would also be loaded to a deeper draft.

Hon. Mr. McDougald: In other words, with improved navigation the shipping interests will construct boats that will fit into the new system?

Mr. FERGUSON: I imagine so. I think the shipping interests are now working on how to best adapt themselves.

Hon. Mr. McDougald: I ask that question because some say that the lake shippers will not take advantage of the deepening.

Hon. Mr. Reid: I would naturally think that they would build vessels the same size as the canal system.

Hon. Mr. McLennan: The greater difficulty of navigation is in finding the larger boats.

Mr. FERGUSON: Well, of course, that could not be carried on indefinitely. Ultimately an economic limit would be reached, but I do not feel competent to give an opinion on that.

Hon. Mr. McDougald: If, after the Welland ship canal is opened, the St. Lawrence is not enlarged, and the grain movement increases rapidly, what economic reaction would you expect?

Mr. FERGUSON: I have already expressed the opinion that the all-water route is the controlling factor in the cost of carrying grain from the Middle West to the Seaboard. As long as the canal route is carrying less than its full capacity other routes are in competition with it, and have to meet the rates established by it, because all grain tributary to it has the choice of moving by it. When it has reached capacity, and there is still a surplus, that surplus must go out by other routes, and those routes, so far as the surplus is concerned, are no longer in competition with the water route. The cheapest of the other routes then becomes the controlling factor, and the surplus will have to pay the rates established by it. This will bring about an increase in rates, and the all-water rate will rise to the new level. A choke on the St. Lawrence will thus cause an increase in the cost of moving the whole crop tributary to the St. Lawrence, and this will, in turn, react on the price of grain, and that on the production of grain. The tendency will be to retard development of grain-growing areas in the West.

Hon. Mr. Reid: Senator McDougald, did the Advisory Committee try to have any Canadian corporation build on the Canadian side if they got the water power?

Hon. Mr. McDougald: We did not discuss that at all. We accepted the recommendations of the Joint Engineering Board, and we assumed that the engineering gentlemen had worked on the most economical engineering solution of the problem.

Hon. Mr. Reid: To the extent of \$3,500,000?

Hon. Mr. McDougald: Yes; the only recommendations we suggested to the Government were that we were not quite satisfied with the engineers on the International section and proposed that they should ask either the Ontario Government or the Hydro Electric Commission to name one or two engineers of their own choice to sit in with the present three Canadian and three American engineers to try and induce the International section to meet the views of the Canadian people, having in mind that very point you are at, and also the control—the question in which we were not quite in accord with the engineers, as to the development by one section or two sections. I have heard it suggested that the adoption of the St. Lawrence river improvement and deepening of navigation would be injurious to the existing railways and it has been put forward that any improvement in navigation that would lower the cost of carrying grain, for instance—take grain as a commodity—would affect the earnings of the railways presently existing, and that therefore, having regard to the future of the railways, that we should not consider this question. In your opinion, Mr. Ferguson, how would the movement through this improved St. Lawrence route affect the railways, if at all?

Mr. Ferguson: The idea expressed there is that the St. Lawrence will come in direct competition with the railway?

Hon. Mr. McDougald: Quite.

Mr. Ferguson: Between the head of the lakes and Montreal?

Hon. Mr. McDougald: Yes.

Mr. Ferguson: Well, I can speak as to grain, I think; that is, I can offer an opinion. I do not think the railways are interested in the haulage of grain from Fort William to the seaboard. They do not haul any of it, to speak of; a few thousand bushels measures the amount of grain that the railways haul to the seaboard from the head of the lakes.

Hon. Mr. Reid: Do not the railways haul an awful lot of grain by Port McNicoll and Midland?

Mr. Ferguson: Yes, they haul a considerable amount, but only at times when the rates on the St. Lawrence get high enough to permit that movement.

Hon. Mr. Reid: That is, when the grain comes from the west in the spring and fall, that is the time they haul a lot.

Mr. Ferguson: What I mean is, taking the larger question, I think that any reduction in the cost of hauling grain from the head of the lakes to Montreal, or in delivering it from the head of the lakes to Europe, will help the railways because, as I have indicated in answer to your last question, that will tend to increase production, and will bring more grain to the railways in the west.

Hon. Mr. L'Esperance: I think that is right.

The Chairman: On behalf of the Committee, I again thank Mr. Ferguson and Mr. Harvie.

ANALYSIS OF COST OF OPERATION OF LARGE AND SMALL LAKE VESSELS

1. Typical modern canal size vessel of type suitable for trading between Port Colborne and Montreal:—

Gross tonnage.. . . .	1,900 tons
Capacity.. . . .	3,000 tons
Keel length.. . . .	250 feet
Beam.. . . .	42' x 4"
Depth.. . . .	20' x 6"
Cost.. . . .	\$220,000
Wheat load on 14 ft. depth.. . . .	85,000 bushels

Cost of Operation

	Per Annum
Wages, food, stores, fittings out, fuel, hull insurance for season navigation.. \$	54,000
Running repairs (variable).. . . .	3,000
Interest—6 per cent on \$220,000.. . . .	13,200
Depreciation—25 year life—\$220,000—\$20,000—\$200,000 at 4 per cent.. . .	8,000

Overhead—say 15 per cent.. . . .	\$ 78,200
	11,730
	<u>\$ 89,930</u>

Total average cost per day in season of 230 days.. . . . \$391

Operating between Port Colborne and Montreal carrying grain—No return cargo. No delays.

Complete round trip—8½ days at \$391.. . . .	\$ 3,323
Add loading and unloading charges ¼oc. bushel.. . . .	765

Total cost of round trip.. . . . \$ 4,088

Cost per bushel, Port Colborne to Montreal, necessary to cover bare expenses and interest on Capital at 6 per cent—no operating delays.. . . . 4.81 cents

Such a vessel could load to 16 feet draft and carry 100,000 bushels of wheat. If she were operating in the upper lakes from Port William to Port Colborne, carrying wheat, suffering no delays and taking no return cargo, the cost per bushel would be:—

Complete round trip—8 days at \$391.. . . .	\$ 3,128
Add loading and unloading charges on 100,000 bushels—\$5.20 per 1,000 bu..	520
	<u>\$ 3,648</u>

Cost per bushel, Fort William to Port Colborne, necessary to cover bare expenses and interest on Capital at 6 per cent—no operating delays.. 3.65 cents

2. Typical moderately large size vessel of type operating between Fort William and Port Colborne:—

Gross tonnage.. . . .	7,400 tons
Capacity.. . . .	10,000 tons
Keel length.. . . .	530 feet
Beam.. . . .	58 feet
Depth.. . . .	31 feet
Cost.. . . .	\$700,000
Wheat load on 20 foot draft.. . . .	370,000 bushels

Cost of Operation

	Per Annum
Wages.. . . .	\$ 28,000
Food.. . . .	7,000
Fitting out.. . . .	2,000
Stores.. . . .	4,000
Fuel.. . . .	36,000
Hull insurance.. . . .	26,000
Running repairs.. . . .	<u>\$ 103,000</u>
Interest—6 per cent on \$700,000.. . . .	3,000
Depreciation—25 year life—\$700,000—\$70,000—\$630,000 at 4 per cent.. . . .	42,000
	<u>25,200</u>

Overhead—say 15 per cent.. . . .	\$ 173,200
	25,800

\$ 199,000

Total average cost per day in season of 230 days.. . . . \$865

SPECIAL COMMITTEE

Operating between Fort William and Port Colborne, carrying grain—No return cargo—No delays—	
Complete round trip—8 days at \$865..	\$ 6,920
Add loading and unloading charges on 370,000 bushels at \$520 per 1,000 bushels..	1,924
	<u>\$ 8,844</u>

Cost per bushel Fort William to Port Colborne, necessary to cover bare expenses and interest on Capital at 6 per cent—No operating delays and no return cargo.. 2.39 cents

3. Typical moderately large size upper lake vessel of type used in paragraph 2 assumed to be operating from Fort William to Montreal at 20 foot draft. No delays—no return cargo:—

Estimated time of round trip

Loading at Fort William..	1 day
Fort William to Montreal..	6½ days
Unloading at Montreal..	1 day
Montreal to Fort William..	6½ days
Total..	<u>15 days</u>

Cost of round trip

15 days at \$856 per day..	\$ 12,975
Loading and unloading charges on 370,000 bushels at \$7.10 per 1,000 bushels..	2,627
Total..	<u>\$ 15,602</u>

Estimated cost per bushel Fort William to Montreal necessary to cover bare expenses and interest on capital at 6 per cent. No operating delays—no return cargo.. 4.22 cents

SUMMARY

Comparative cost of carrying grain by Upper Lake and Canal vessels

Cost by canal vessel from Fort William to Port Colborne..	3.65 cents
Cost by Upper lake vessel from Fort William to Port Colborne..	2.39 cents
Difference per bu. in favour of large vessel..	1.26 cents
Probable saving in cost of transporting grain from Fort William to Montreal in large lake freighters through an enlarged waterway.	
Cost under present system—Fort William to Port Colborne by typical large lake freighter..	2.39 cents
Port Colborne to Montreal by typical canal freighter..	4.81 cents
Total cost..	7.20 cents
Estimated cost Fort William to Montreal by typical large lake freighter operating through an enlarged canal system at 20 ft. draft..	4.22 cents

Estimated saving.. 2.98 cents

NOTE.—In order that comparison may be fair, all calculations are made on the basis of no delays and no return cargoes.

ALEX. FERGUSON,
Montreal, 28th May, 1928.

SUPPLEMENTARY

Probable saving in cost of transporting grain from Fort William to Montreal, after the opening of the Welland Ship Canal, assuming carriage from Fort William to Prescott in large lake freighters and from Prescott to Montreal in present canal sized vessels.

Estimated Time of Round Trips

	Days	Hours
<i>Fort William to Prescott—</i>		
Loading at Fort William..	1	0
Fort William to Port Colborne..	3	0
Welland Ship Canal..		18
Port Weller to Prescott..	1	0
Unloading at Prescott..	1	0
Prescott to Fort William..	4	18
	<u>11</u>	<u>12</u>

Prescott to Montreal—

Loading at Prescott..	1	0
Prescott to Montreal..	1	6
Unloading at Montreal..	1	0
Montreal to Prescott..	1	18
	<hr/>	
	5	0

Cost

Fort William to Prescott, typical large lake freighter, 11½ days at \$856 per day..	\$	9,844
Loading and unloading charges on 370,000 bu. at \$7.10 per 1,000 bu.. . . .		2,627
	<hr/>	
	\$	12,471
Estimated cost per bushel, Fort William to Prescott, necessary to cover bare expenses and interest on capital at 6 per cent.: No operating delays—no return cargo..	3.37	cents
Prescott to Montreal, typical present canal vessel, 5 days at \$391 per day.. . .	\$	1,955
Loading and unloading charges, 9¼c. per bushel on 85,000 bushels.. . . .		765
	<hr/>	
	\$	2,720
Estimated cost per bushel, Prescott to Montreal, necessary to cover bare expenses and interest on capital at 6 per cent. No operating delays—No return cargo..	3.20	cents
Estimated cost under present conditions—Fort William to Montreal.. . . .	7.20	cents
Estimated cost after opening of Welland Ship Canal and before deepening of St. Lawrence Canal Systems—		
Fort William to Prescott..	3.37	
Prescott to Montreal..	3.20	
	<hr/>	
	6.57	cents
Estimated saving per bushel..	0.63	cents

FINAL SUMMARY

Estimated costs of hauling grain between Fort William and Montreal on Great Lakes system using typical large lake freighters at 20 foot draft and typical present canal freighter at 14 foot draft. No delays and no return cargoes.

All costs given are for one bushel of wheat

Under present system—

Fort William to Port Colborne..	2.39	cents
Port Colborne to Montreal..	4.81	"
	<hr/>	
	7.20	"

After opening of Welland Ship Canal and before deepening of St. Lawrence Canals—

Fort William to Prescott..	3.37	cents
Prescott to Montreal..	3.20	"
	<hr/>	
	6.57	"

After enlargement of St. Lawrence Canal System—Basis 20 ft draft—

Fort William to Montreal..	4.22	cents
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Estimated reductions—Fort William to Montreal—

Saving in cost anticipated on opening of Welland Ship Canal .. .	0.63	cent
Anticipated additional saving on opening of enlarged St. Lawrence system..	2.35	"
	<hr/>	
Total estimated saving..	2.98	"

ALEX. FERGUSON,

Montreal, 5th June, 1928.

TUESDAY, 29th May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River resumed this day at 4.30 o'clock p.m.

The Honourable C. E. Tanner presiding.

Professor W. W. GOFORTH, of McGill University, Montreal, was called as a witness:

The CHAIRMAN: Now, Mr. Goforth, first of all you had better explain who you are, so that the Committee may know your qualifications.

Prof. GOFORTH: Mr. Chairman I am a graduate of the University of Toronto, and for the past four years have been attached to the staff of McGill University in the Department of Economics and Political Science. In the first two years of that period I was a lecturer, and during the past two years I have held the post of assistant professor. The courses in which I have specialized are those of Transportation and Canadian Economic Problems. Naturally, therefore, my work has brought me into contact with this problem of the St. Lawrence and its projected development.

I was first interested in this matter some four years ago when editing for publication a research monograph by one of our graduate students, L. M. Fair, on "The Transportation of Canadian Wheat to the Sea". The St. Lawrence question was not as widely discussed at that time as it is at present, but I had started to study it and gather information on it. In the spring of 1927, I was requested to prepare a report showing whether or not the hydro-electric power resources of the St. Lawrence had commercial possibilities, and what, if any, would be the public benefit derived from such resources if developed. I shall refer later to certain facts and conclusions of the report. In connection with this I was naturally led into a wider study of the whole question of the St. Lawrence Deep Waterway. Since my return from the Pan-Pacific Conference at Honolulu last summer, at which I was a delegate, I have had occasion to study this question further, and have written on it for the Queen's Quarterly and other publications. The evidence which I have prepared is not only the result of my own investigations, but also of material and opinions which I have secured from different quarters and co-ordinated.

I would like first, to give a summary of the main economic factors involved in a question of this kind. I have divided the subject under seven main heads.

The first factor is that of navigation and shipping. The second one, closely dependent upon the first, is the agricultural factor. The third is the factor of hydro-electric power with which and with the related factors of population and industry my investigation has been chiefly concerned. Then there is the railway factor, or the potential effect of the Deep Waterway on the traffic density of Canadian railways and such diversions if any, which may be expected to result from the Deep Waterway, and further the anticipated effect of the project on railway traffic during the construction period and subsequent to it. Then there is the financial factor—the different questions involved in costs, and the movements of prices, and so on.

There are several points in connection with the factor of navigation and shipping which are of particular interest to an economist, and which have, I think, not been emphasized in previous evidence. First, that it is becoming increasingly apparent from an analysis of cost ratios that there would be very little likelihood, if any, of liners, either passenger or composite liners, or freight liners, traversing the route above Montreal. The much higher cost of traversing a restricted waterway, the much lower overhead charges per net ton of the lake

steamer, the question of the length of ocean as compared with lake waves, and the resultant variation in strains and stresses makes it almost impossible from a strictly economic view for ocean vessels of the liner type to compete with the specialized type of lake vessels or for the latter to enter the field of ocean shipping. On the other hand, the tramp, or the vessel which is not tied to any definite route and for the most part independently operated, presents a rather different situation. It is my opinion that the tramp steamers or a fair proportion of those which enter the St. Lawrence, will traverse this inland route. Up to the present time the tramp steamer has not used the St. Lawrence to any great extent. The reason for this becomes apparent if one compares Montreal with New York. New York is at the apex of a wide angle of coast line, the sides of which are studded with dependent ports each controlling its little hinterland of traffic. In other words, New York forms the centre or charter market of a very large tramp steamer traffic because the possibility of a vessel arriving or returning empty or light is reduced to a minimum. Montreal, on the other hand, stands at the apex of a very narrow angle, the sides of which have no dependent ports except Quebec to assure to tramp steamers what they most require, a diversified two-way traffic. The average tramp steamer has to come empty or in ballast to Montreal to return with cargo.

Hon. Mr. McLENNAN: Are not those largely triangular voyages to New York?

Prof. GOFORTH: As a rule, yes—say from Le Havre to Baltimore, then to New York. In the same way, with the waterway, Montreal would have behind it a whole group of dependent ports. The tramp does not maintain the same large crew as the liner, nor the same proportionate space for storage, bunkers, engines, and so on. They would be able to navigate above Montreal, because they could bring other traffic which ordinarily would go to New York or Baltimore and from there overland to Cleveland, Detroit, Buffalo, and so on, and those conditions would tend to produce the ideal state of shipping on the St. Lawrence, a two-way traffic, the lack of which is a serious drawback to the St. Lawrence under present conditions. While examining this feature the question naturally arises as to whether or not Montreal would remain the key port of transfer for the whole system. It is my opinion that Montreal not only for physical reasons but because it is the natural point of convergence for both rail and water traffic of almost infinite variety, would not only retain its present functions but be considerably enhanced in importance with the completion of the Deep Waterway. As a great grain port, it has been suggested in some quarters that Chicago may develop into a formidable rival of Montreal if an ocean route is provided into the interior. But Chicago is unfortunately situated. It is not on the main route of the Great Lakes, and therefore could never hope to act as a chartering centre for the tramp traffic of the Great Lakes. The importance of this tramp steamer condition lies chiefly in the moderating influence which from experience elsewhere, it may be expected to exercise on present liner rates on important commodities moving to world markets from the St. Lawrence basin. I think this accounts, even if the motive is more or less subconscious, for the very bitter antagonism existing in certain centres and on the part of certain interests towards the Deep Waterway. The rates from Montreal which are at present higher than those from New York would be brought to a level more in keeping with the distance involved, for the present difference is considerably more than could be accounted for by the higher insurance charges of the All-Canadian route.

Hon. Mr. McLENNAN: What you say rather proves that the liner rates in Montreal are not so high as to attract the floating tramp tonnage. If, for example, they are excessively high, the tramps would come?

Prof. GOFORTH: They would come anyway. There is a difference between actual and potential competition. There is always the potential competition of a tramp coming there empty and competing against a rate which may become excessively high. I do not claim the present rates are excessively high, but only that they are higher than the difference in insurance charges on the two routes would warrant. In other words, the equation in favour of the tramp would be greater if there was a better opportunity for it to secure a diversified two-way traffic.

Hon. Mr. REID: I have understood that the rates were the same from all Atlantic ports—Halifax, Saint John, Quebec, New York, and so on—a kind of combination.

Prof. GOFORTH: That is only true to a very limited extent. The North Atlantic Conference merely sets minimum rates but does not attempt to interfere with maximum rates. Rates differ according to local competitive conditions. At the time of the British coal strike when American coal was moving eastwards across the Atlantic, there was a very material rise in grain rates.

Hon. Mr. REID: Under normal conditions?

Prof. GOFORTH: There is nearly always a differential in favour of New York, partly on account of the difference in insurance, partly on account of the tramp condition previously mentioned, and partly owing to legislative restrictions on the deferred rebates policy of steamship lines in the United States.

Hon. Mr. McLENNAN: And the greater chance of finding a charter.

Prof. GOFORTH: That is the chief point. If they cannot secure traffic in New York they are chartered for traffic from other neighbouring ports.

Hon. Mr. McLENNAN: Do you happen to know the development of shipping in Philadelphia and Boston during recent years?

Prof. GOFORTH: In the absence of data on that point, I would rather refrain from any definite statement on the shipping conditions of these two ports.

Now, in coming to the question of savings to be effected in inland water transportation if the Deep Waterway is completed, my own computations show a slightly higher figure of saving in costs per bushel from the head of the lakes to Montreal than that which was quoted this morning of 2.98 cents. My estimate is based on the maintenance of substantially similar bushel-mile costs below Port Colborne as above when the larger upper lake type of vessel can navigate the whole distance. The rate at present over an average period from Fort William to Port Colborne is 3 cents a bushel, while the rate from Port Colborne to Montreal which is only about half the distance averages about 6.6 cents a bushel, making a total of 9.6 cents.

Hon. Mr. REID: Under the present system?

Prof. GOFORTH: Under the present system. This would show a saving of approximately 4.8 or 5 cents a bushel, allowing for the slightly greater proportion of restricted navigation in the lower section as described.

Hon. Mr. REID: That would be from Fort William to Montreal?

Prof. GOFORTH: From Fort William to Montreal. Allowing for a substantially similar bushel mile cost of operation it would give a total cost of 4.6 or 4.8 cents per bushel moving from Fort William to Montreal.

Hon. Mr. REID: I suppose you have also worked this out. It would take five or six or seven years before we can go from Prescott down to the sea?

Prof. GOFORTH: Yes or possibly more if you are referring to the probable time necessary to complete the whole project both for navigation and power.

Hon. Mr. REID: How does it work out?

Prof. GOFORTH: It would not involve a cessation of water traffic during the whole period of construction, especially if the southern alternative plan be adopted for the middle section of the St. Lawrence, between Lake St. Francis and Lake St. Louis, which if proceeded with first, as suggested in the National Advisory Committee's report, would permit the continuous use of the old Soulanges canal during the period of construction. The other two sections would involve temporary cessation of water traffic. In my opinion the Canadian railways would gain by this temporary diversion of traffic from the lower water route.

Hon. Mr. REID: The new Welland canal will be through in 1930 and boats will be able to go down to Prescott and Kingston. Now, what would the rate be, say, from Fort William through to Montreal going by the 14-foot canal to Montreal?

Prof. GOFORTH: By barges?

Hon. Mr. REID: Yes, or steamers, until this work is through?

Prof. GOFORTH: I think that 7·6 cents would be a close approximation, in other words a saving of 2 cents on present conditions but 2·8 to 3 cents more than my estimate for uninterrupted through traffic of large lake vessels.

The real menace of an uncompleted Deep Waterway to traffic by our Canadian outlet seems to be in the crystallizing of the Oswego-Albany route when the new Welland canal is completed. It merely transfers the leakage of Canadian traffic from Buffalo to a route which in many respects shows greater competitive advantages than any previous grain outlet via American Atlantic ports. I am not referring to an all-American canal which I do not believe deserves serious consideration, but a short rail haul coupled with extensive terminal developments at Oswego and Albany.

Hon. Mr. REID: How many miles would it be by rail?

Prof. GOFORTH: About 135 miles. It would be a considerably shorter haul, of course, than from Buffalo to New York, which is over 300 miles.

Hon. Mr. REID: How far is it from Prescott to Montreal?

Prof. GOFORTH: About 130 miles. The point is that plans have already been worked out for making Albany an ocean port by deepening the Hudson river and constructing extensive terminal works at the State Capitol. If this is carried out, along with the development of Oswego as the lake terminal, and the expansion of rail facilities connecting them, then this route becomes a much more serious competitor than if it is forestalled. In other words, you will have then an established group of interests in the State of New York and an investment which has been made. The opposition, now mostly of a hypothetical nature in New York State towards the Deep Waterway, would then have a very strong basis provided by powerful interests both public and private.

Hon. Mr. REID: Have you got the real figures between Oswego and Albany?

Prof. GOFORTH: The rates for such traffic as I have spoken of would of course be set by the Inter-State Commerce Commission when the new situation arises, in other words when the Welland canal is completed.

Hon. Mr. REID: In a year.

Prof. GOFORTH: Two years from now, possibly longer.

Hon. Mr. REID: Have you any idea what the railway rates are from Oswego to Albany now?

Prof. GOFORTH: I have not these rates before me at the moment.

Hon. Mr. CURRY: What is the intention—to make Albany a deep-water port?

Prof. GOFORTH: Yes, as far as it is in the power of New York State to do so. Now in turning to the question of the present and potential area served by the St. Lawrence as an outlet for Western Canadian wheat we find that the present watershed of grain traffic going east or west is roughly a line drawn north and south through Western Saskatchewan about sixty miles from the Alberta border. Of course this line varies seasonally and over long periods owing to such temporary conditions as a late crop moving after navigation of the St. Lawrence becomes prohibitive. We may however consider it as an average line of division in east or west shipments of grain. The reason for enlarged shipments via Vancouver and more recently Prince Rupert is chiefly due to the very rapid growth of wheat production in the Western Alberta region already served rather than to any material expansion of their hinterland by rate equalizations. Now even if the lowest estimate of economies resulting from St. Lawrence improvement be taken as a base the differential line inevitably moves westward into Alberta; in other words the region served by the St. Lawrence becomes considerably enlarged.

Hon. Mr. CASGRAIN: Alberta grain will go by Vancouver.

Prof. GOFORTH: It does at present and a substantial portion of it will continue to follow that route but if there is a reduction of even 3 cents in the costs of St. Lawrence transportation, and still more so if there is a reduction of 5 cents, it will mean that the differential line will move westward into Alberta. The portion of this dividing line of traffic will depend upon the extent of economy effected on the St. Lawrence Route. This brings us to my second factor—that of agriculture—in other words the anticipated effect of the Deep Waterway on the net return of the Western farmer and his general purchasing power. Over a period of eight years his net return after paying all costs of production, including interest and sinking fund on his investment, has not averaged more than six or seven cents per bushel of wheat, which is the basic product affected in the situation we are now considering.

Hon. Mr. GRAHAM: That does not include his labour?

Prof. GOFORTH: Yes I have allowed for that in making my estimate, but only insofar as his cost of living represents a return for his labour. Now since his margin of return is exceedingly small in relation to the market price of his grain, any increment arising from cheaper transportation would, from analogous experience in Kansas and elsewhere, result in greater attraction to agricultural immigrants and also a tendency towards greater wheat production on the part of the present farmers.

This brings us to the third factor, namely that of hydro-electric power, already indicated as a very valuable by-product of the waterway. Three-fifths of the five million horse-power total is strictly Canadian and may be developed without reference to the United States. The Kellogg note of last April not only admits that the disposition of this power is a purely Canadian domestic question, but further states quite definitely that the Canadian share of power on the international section belongs inalienably to Canada, by whatever agency it may be developed. To give the actual wording of this assurance given by the United States Secretary of State, I quote, as follows, from his correspondence with the Hon. Vincent Massey: "The United States fully recognizes the right of the Dominion of Canada to the ownership and use of the Canadian share of the power which may be developed on the international section of the waterway, as well as to all that developed in the national section, and it recognizes also that the disposition of the power is purely a domestic question. It recognizes further that this share is an inherent attribute of Canadian sovereignty, irrespective of the agency by which the power may be developed."

Hon. Mr. REID: Is that from Cornwall east?

Prof. GOFORTH: It would include the Canadian share of approximately one million installed horsepower at the international section just above Cornwall, as well as the three million horsepower of the purely Canadian sections below Cornwall.

Hon. Mr. REID: What I mean is that the only question that would arise as to how much is in our country and how much is in the United States is from Cornwall west.

Prof. GOFORTH: That is true. West of Cornwall the boundary line is so located as to leave the greater part of the river in United States territory, and the single-stage plan for navigation and power development of the international Joint Commission not only places the canal on the United States side of the boundary but the whole of the power-house also. I am personally of the opinion that not only should the canal be located on the Canadian side of the river, as suggested in the Ontario Hydro-Electric Commission's report of 1924, but that the power house in which the million horsepower belonging to Canada is to be developed (if we assume the single stage plan) should be shifted slightly northward so as to be wholly within Canadian territory. The relatively small extra cost involved would I feel be more than counterbalanced by the sense of security and absolute control which location in our own territory alone could give.

Hon. Mr. REID: And in a separate building, I suppose, rather than an imaginary line running through the centre of the building?

Prof. GOFORTH: I hardly think that is a material factor, providing that the imaginary line is the international boundary. If you will examine the charts provided you will agree I think that such a change in the plans would not involve any very serious engineering difficulties.

Hon. Mr. REID: Don't you think it would be better if we had the building entirely separate—one on each side of the river?

Prof. GOFORTH: If it did not involve any material increase in cost it might be desirable. It has been suggested that for a mere extra 3 million or 3½ million dollars this could be done, and from my examination of this question of power export, it would certainly seem much safer to put it wholly on the Canadian side of the line.

Hon. Mr. CASGRAIN: How much would it be per horse-power?

Prof. GOFORTH: That depends on what portion of the joint navigation and power works is to be charged to the power.

Hon. Mr. CASGRAIN: It was \$265.

Prof. GOFORTH: I venture to say that your estimate is rather high, for if you apply that figure of \$265 to the whole five million potential installed horsepower on the St. Lawrence, you get a total cost for power alone of \$1,325,000,000, whereas the estimate given by the Joint Commission for the full development of power and navigation of the St. Lawrence does not exceed \$650,000,000. In other words the average cost of developing St. Lawrence power, even if all navigation works be charged to it, would not be more than \$130 per horsepower, which approximates the development cost at Chippawa. There is one point in favour of slightly higher costs in the power development of the St. Lawrence as compared with certain other regions, and that is the greater equalization of seasonal flow on the St. Lawrence as compared with the Gatineau, the St. Maurice and other South flowing tributaries of the main river. With a national retention reservoir in Lake Ontario the costly works for regulating the flow of the river are not necessary as they have been on the two rivers just mentioned.

The question naturally arises as to the ability of the two Central Provinces of Canada to absorb within a reasonable period the enormous resources of hydro-

electric energy, which lie undeveloped in the St. Lawrence River. Export of any part of Canada's share of the power to the United States is not to be considered, the urgent demands of future industrial growth in Canada for every horse-power of this wealth has been amply demonstrated and is now accepted, practically without question. The outstanding fact of electrical growth in Canada has been the doubling of our developed resources in less than seven years, the rate of development in Quebec province has been still more rapid.

Hon. Mr. REID: About what total quantity is developed in the province of Quebec?

Prof. GOFORTH: Approximately 2,150,000 horse-power has been developed in Quebec up to the present. The remarkable feature of this electrical situation is that consumption in kilowatt hours has increased more rapidly than the rate of development. This leads to logical conclusion that this basic product, electricity, because it extends into almost every phase of industrial and domestic activity, is not subject to the usual evils of overproduction. While it is hardly reasonable to expect this process of doubling every six or seven years to continue indefinitely yet conservative opinion among experts is that we will continue to develop and utilize an increment of two and a half million horse-power every seven years for several decades to come; of this amount the share of the Central provinces would approximate two million horse-power. Now even making allowance for developments other than the St. Lawrence, we would then urgently require the whole of our share in St. Lawrence power by 1945, providing the normal expansion of Canadian industry and commerce is permitted to continue. This is particularly true of power situation in Ontario. The maximum Canadian development of power at Niagara which is permitted by treaty, namely the full diversion of 36,000 cubic feet per second has already been reached. The introduction of Gatineau power will only relieve the situation temporarily. Already Western Ontario particularly is faced with a very serious power shortage for industrial extensions during the next few years, a situation which shows little indication of relief unless the region from say Toronto eastward is to be supplied from the St. Lawrence, thus releasing Niagara power for the Western Ontario market only. A note-worthy example of the far-reaching social and economic transformation which a large power development affords to the district it serves is indicated in the history of the late J. B. Duke's enterprise, the Southern Power Company, in North Carolina, during the past fourteen years. Up to 1913, North Carolina was regarded as one of the most backward of American states, both as regards economic conditions and in other general standards of culture. It was one of the most illiterate states in the Union. The transformation that has taken place in little more than a decade is almost unprecedented. Its school system, as also its highways, closely rival those of New York state. This general and wide spread prosperity is the immediate result of the establishment of 167 cotton mills, many of them having moved down from New England, and all located along 143 miles of railway. While these and the labour they afford are the visible cause of higher living standards, yet the basic and fundamental reason is the provision of cheap power, which made the migration of the cotton mills possible.

The history of the Shawinigan Water & Power Company is another excellent example of the influence of cheap and abundant power. The city of Shawinigan Falls, which did not exist twenty-five years ago, is now the heart of a large power generating district, and has become one of the most important electro-chemical centres on the continent. More than 130,000 horse-power are at present being used by industries located in this young city, and not one of these has a counterpart in the Montreal district. This figure does not include power for pulp and paper purposes. The Aluminum Company of Canada has a complete plant for the manufacture of wires and cables, and uses for this purpose

upwards of 50,000 horse-power. The Canada Carbide Company utilizes over 30,000 horse-power for the manufacture of calcium carbide and other by-products. The Canadian Electric Products Company Limited has a large and modern electric-chemical plant at Shawinigan Falls for the manufacture of acetaldehyde, acetic acid, and the derivatives from acetylene gas. Its products are exported to all parts of the world. The Canadian Carborundum Company operates a large plant producing carborundum, aloxite and ferrosilicon. This company utilizes 12,000 horse-power in its electric furnaces. The social effects of the phenomenal growth of Shawinigan Falls, Grand Mère and Three Rivers need not be enlarged upon. The conclusion is that electrical development not only supplies the demand of normal industrial expansion, but possesses the quality of inducing that demand.

The telephone industry presents a marked contrast to that of electric power, because with every increase in the number of telephones you get a multiplication rather than addition in the number of potential connections; but with electric power every increase in the number of customers enables the producer to carry the increased current of electricity over practically the same transmission and distribution system without a proportionate increase in overhead. This tendency towards diminishing costs and increasing returns per unit in electrical production and transmission is its chief guarantee against a glutted market. A very interesting document on this subject is the Bonbright Prize Essay on the growth of the electrical industry during the decade from 1920 to 1930, by a Canadian, Mr. David Cowan, an employee of the Sun Life Assurance Company. The prize was won in competition with the best experts in the United States. Mr. Cowan's thesis demonstrates clearly the relative impossibility of over-production of electricity. I have not yet heard of a case where electric power developed at reasonable cost has gone to waste.

To turn for a moment to the power situation in the Montreal district, which has a very practical bearing on question of the actual need for St. Lawrence supply during the next few years. This very important district besides its older sources of supply from several plants within a 25 mile radius has drawn increasingly during the past decade from the Shawinigan establishments on the St. Maurice river, some 90 to 95 miles transmission distance from the heart of Montreal. New additions of power from these sources will no longer be available to supply expanding requirements after 1930. Developments on the Rivière des Prairies, or Back River totalling 60,000 horse-power will only supply the needed additions up to 1931 or 32 at the latest. Yet the average annual increase of requirements in the Montreal district for the next twelve years is estimated conservatively as at least 35,000 horse-power per year. This figure, of course, does not allow for any exceptional industrial expansion, but merely normal growth. It does not include the amount necessary for the attraction of new industries on a large scale. It would appear then that the Montreal district could effectively absorb a substantial portion of the St. Lawrence power available on the lower two sites within a very short radius of the city, that is at Melocheville and Lachine. The question naturally arises at this point as to whether the extensive new developments on the Gatineau and Saguenay rivers cannot eliminate the necessity of introducing supplies from the St. Lawrence. They are even now "tied in" with the Montreal network, and the interchange of off-peak loads will undoubtedly benefit all concerned, but there are several reasons why neither of these centres can be expected to play an important part in supplying the expanding power requirements of Montreal. In the case of the Gatineau I am informed that practically the total supply remaining, after deduction of the amount contracted for by the Ontario Hydro-Electric Commission will be required for local industries in the Gatineau Valley. The same condition

prevails to a large extent in the Duke-Price developments on the Saguenay river. There is the additional consideration that Ile Maligne power is 280 miles transmission distance from Montreal, an economically prohibitive distance for permanent transmission if it is remembered that it involves a total line loss of approximately 15 per cent of the power in addition to the overhead costs of expensive transmission equipment.

Hon. Mr. CASGRAIN: How much every 100 miles does that increase the price?

Prof. GOFORTH: That depends on several things. It depends partly upon the voltage of the current and the load transmitted, for the line losses per unit of distance are greater on small loads than on large.

Hon. Mr. CASGRAIN: Isn't it \$3 per horse-power for every 100 miles you carry it?

Prof. GOFORTH: Approximately that.

Hon. Mr. CASGRAIN: So that for 280 miles at the figure you take, \$3 or less than that, it would be such a prejudicial difference that they would not be able to compete against power developed locally?

Prof. GOFORTH: No except at a loss if the local power is available in sufficient volume.

Hon. Mr. REID: Then Toronto will not be in it with Montreal when that power is developed?

Prof. GOFORTH: I would not reach such a conclusion, for in the first place Toronto is 40 miles closer to the International power site on the St. Lawrence, than Montreal is to Ile Maligne. As you know, power from Niagara at the present time is transmitted as far as Windsor, Sarnia, and Wallaceburg, approximately 240 miles. Competitive conditions determine the rate which is charged—not only competition against other hydro-electric supplies, but competition against the substitute use of fuel, and while the level of cost is determined largely by the distance, yet the rate which is charged is not necessarily determined by the cost.

Hon. Mr. GRAHAM: In anything?

Prof. GOFORTH: Yes, in anything. The cost is an influencing factor, but never a determining factor.

There are two major outlets or markets for St. Lawrence power which, in addition to normal industrial growth, should become increasingly important during the next two decades. The first concerns the development of an extensive electro-chemical and metallurgical industry in the valley of the St. Lawrence to refine and manufacture the rapidly growing supply of mineral products of the two central provinces, notably of the northern region. While such centres as Port Colborne, Shawinigan Falls and Arvida have built up large establishments of this type, yet the greater part of the raw materials of our mines and smelters is manufactured abroad, in Wales, West Virginia and Belgium especially. Montreal, however, if provided with a large surplus of power would form an ideal centre of such activity, because it possesses all other factors necessary to its success. It is the point of convergence of both Canadian railway systems and occupies a more truly central position in relation to major mining developments than any other point in the two provinces. It possesses a larger floating surplus of industrial labour, over a period of years, than any other city in Canada. It has been stated to me that upwards of half a million horsepower could be usefully employed in this class of industry in the St. Lawrence valley if carried out on a scale commensurate with the anticipated supply of raw materials from our mining regions, and the prospective increased markets for finished products both

in Canada and elsewhere. The special importance of abundant and relatively cheap power in this type of industry is that electricity accounts for a higher percentage of cost of production than in any other manufacturing group.

The second major outlet or market is in the field of transportation. Railway electrification of terminals in such large centres as Montreal and Toronto is already pretty well assured within the next few years. The further problem of electrifying trunk lines, especially between such cities as the two just mentioned and Ottawa and Quebec, has received considerable study during recent years. The problem is two-fold. First, it involves the ability of electric power not only to compete with steam, or, as has been recently suggested, internal combustion engines, on a straight production cost per unity of energy, but also its ability to carry a larger overhead, in the form of expensive electrical equipment along the right of way. Secondly, it involves a sufficient traffic density per mile of line to equalize power loads on the one hand, and on the other to provide sufficient revenue to cover the annual charges upon the additional equipment. The problem of competition with coal oil or oil fuel depends to a large extent on the future tendency of prices of bituminous coal on the one hand and of gasoline on the other. The general tendency in the bituminous mines of this continent for a decade at least has been towards deeper levels and thinner seams. This seems to suggest at least the probability of a gradual rise in bituminous prices over a long period. The oil reserves in different parts of the world are by no means inexhaustable, and though there is no immediate prospect of severe restrictions in supply, yet the tendency is undoubtedly in that direction. The required frequency of trains has been variously stated at around twenty trains a day.

Hon. Mr. CASGRAIN: Sixteen a day.

Prof. GOFORTH: That may be true, but the figures I have stated is a little more conservative as a basis for estimating future requirements. If all these factors are present the electrification of railways will be not only possible, but highly desirable, from a strictly commercial viewpoint. I mean, it will be economically profitable for the railway companies to make the extra expenditure to supply the electrical equipment.

I have estimated that if and when such electrification takes place on the trunk lines referred to, it would require at peak load between 500,000 and 600,000 horse-power to operate the system.

Hon. Mr. CURRY: In what length of time?

Prof. GOFORTH: Within fifteen years, allowing for normal increase in railway traffic density.

Hon. Mr. CURRY: Fifteen years hence?

Prof. GOFORTH: Like all statements regarding the future, it must be regarded as an approximation, an estimate. Yet in arriving at this general conclusion I have taken into consideration the rate of growth in railway traffic density on Canadian lines as far as the information has been available, and also reports and papers concerning the tendency of costs in bituminous industry in the United States and elsewhere.

Hon. Mr. CASGRAIN: About what does it cost a mile to electrify a railroad?

Prof. GOFORTH: Approximately \$45,000 per mile of line.

Hon. Mr. CURRY: How much for installation?

Prof. GOFORTH: The figure given includes all fixed costs of electrification, but not the current power charges, which, subject to the terms of the contract, would vary more or less according to the density of traffic. There are of course considerable economies which may be effected if the railway is double tracked,

but for one mile of line costing \$75,000 it would involve an additional expenditure of \$45,000 to provide all equipment necessary for full electrical operation.

Hon. Mr. REID: That is, line and all?

Prof. GOFORTH: Yes, line and all.

Hon. Mr. REID: Does that mean for running one main line of railway, operating it like a train on the main line?

Prof. GOFORTH: Yes, as is now done by the Canadian National Railways from their "Tunnel" station in Montreal.

Hon. Mr. REID: Yes, but I mean for a main line railway \$45,000 a mile would not do it?

Prof. GOFORTH: Forty-five thousand dollars a mile would supply the additional equipment necessary for electrical operation.

Hon. Mr. REID: For one mile?

Prof. GOFORTH: Yes.

Hon. Mr. REID: That is for the suburban lines?

Prof. GOFORTH: No, I am referring to those now operated as steam-railway lines, not suburban radials. It is very unlikely that electrification will ever be applied to small branch lines.

Hon. Mr. REID: I am surprised, because I always understood that the cost per mile was twice that, say, from Toronto to Kingston, or some such line. I always understood that for operating the main line it cost two or three times what you say, \$45,000 a mile.

Prof. GOFORTH: I have not referred to the costs of operation but initial costs of installation.

Right Hon. Mr. GRAHAM: On the basis of \$75,000 per mile, your line completed would cost you approximately \$120,000?

Prof. GOFORTH: Yes, exactly.

Right Hon. Mr. GRAHAM: The line completed with electrical equipment.

Prof. GOFORTH: Yes, with electrical equipment.

Hon. Mr. CURRY: That is the line plus the electrical installation.

Right Hon. Mr. GRAHAM: That would be the basis you would have to work on.

Prof. GOFORTH: In other words, it would not pay the railway unless a sufficient frequency of trains could be assured.

Right Hon. Mr. GRAHAM: Unless you had a sufficient frequency of trains your overhead would be excessive.

Prof. GOFORTH: It would be too great, yes; but with the frequency factor, which has been suggested as sixteen, but which I would, to be more conservative, place at twenty, that would become possible. On certain lines that frequency has practically been reached. Since 1920, the actual increase in the traffic density of Canadian Railways has been 30 per cent per mile of line. Allowing for even a slowing down of this ratio of increase in the next decade or so, we should approach in fifteen years, at most, the time when the question of electrifying the main trunk railway lines of the central provinces will have to be faced. It may never be realized in certain sections of our railway network where sparse population or traffic shows little sign of material increase, but in the more densely populated regions, well supplied with hydro-electric power, it is a probability to be reckoned with.

Right Hon. Mr. GRAHAM: It will come into practical politics if you stop buying coal in Nova Scotia and Alberta.

Hon. Mr. CASGRAIN: At Ile Maligne, just the transmission line alone, 140 miles, cost \$6,000,000. That is \$42,800 and some odd dollars a mile, just for the transmission line. Then you have to electrify your road besides.

Prof. GOFORTH: The case you have quoted is hardly analogous, for in the situation we have discussed the right of way is already owned and improved by the railway company.

The CHAIRMAN: Professor, have you much more ground to cover?

Prof. GOFORTH: There were several other things Mr. Chairman.

The CHAIRMAN: I do not want to hasten or abridge your evidence. I want just to remind the Committee that it is half past five, and we would like to get as much from the Professor before we adjourn as possible.

Prof. GOFORTH: Thank you Mr. Chairman. I will deal next with the anticipated growth in population which may be expected to result from the development of Canada's four million horse-power on the St. Lawrence. In the "Journal of Electricity" June 1921 there appeared an interesting table which demonstrates among other things the number of people employed directly or indirectly as a result of the development of 1,000 horse-power. The number, 385, is based on the average of a great number of cases and presupposes of course a sufficiently reasonable level of rates to attract capital and induce industrial development. It is also intended to represent not an immediate but an ultimate ratio which is attained only when the power is fully absorbed and the district which uses it equipped with all the dependent services necessary to a modern community. Now to arrive at the ultimate figure of dependent population it is necessary to apply to this figure of employment a family multiple. The average size of family in the two central provinces is approximately five. This gives for the ultimate absorption of St. Lawrence power a dependent population of 7,700,000. It may be interesting to note that this figure, quoted in the Senate not long ago, represents very closely the actual relation of population to power in Canada at the present time. It has been suggested, however, that in the case of the St. Lawrence, since the type of industry developed will probably use a high proportion of power to labour, and since in Quebec, at least, there is more than one member of a family gainfully employed, that a lower total would be a more reasonable anticipation, I personally lean towards the latter view. Nevertheless the principle I believe is sound, and whether 4,000,000 or 7,000,000 or 7,700,000 represents the ultimate new population provided for by the development of the power, it certainly is a factor worth taking into consideration in deciding the balance of benefit or burden which may accrue to Canada from the development of the power. Nor do I consider that this population growth will be limited to the St. Lawrence Valley or Western Ontario by the release of Niagara power, for the growth of the centre produces a proportionate increase in its demand for the commodities of other parts of the Dominion.

Hon. Mr. CASGRAIN: You mean that cheap power will draw a lot of people?

Prof. GOFORTH: Yes, ultimately. It may not draw them right away. The St. Maurice development did not immediately cause Shawinigan Falls, Three Rivers, etc., to leap ahead in population, but you will find that the growth of population in those centres and in the region around was much more rapid after the development of power than in the preceding period. You will find that several of the counties in the region of the St. Maurice Valley were actually declining in population before the power developments took place. The collective population of the three main urban centres of this district has a little more than doubled in fifteen years.

Hon. Mr. CASGRAIN: It has not been increasing for the last fifteen years at Grand'Mère. I know that.

Prof. GOFORTH: Of course it must be remembered that in the case of these three cities much of the power has been used in the development of Montreal, of the asbestos district around Thetford Mines, and other regions, but even if you take simply the growth of the three St. Maurice Valley cities just mentioned my statement is I think borne out by the accompanying table showing their growth between 1911 and 1926, the last figures being estimates of the Shawinigan Water and Power Co.

	Population		
	1911 (Census)	1921 (Census)	1926 (S.W. & P. Co. esti- mate)
Shawinigan Falls.....	4,265	10,625	14,000
Three Rivers.....	13,980	22,367	25,000
Grand'Mère.....	4,783	7,631	8,500
	23,028	40,623	47,500

There is this further point which I think makes the St. Lawrence development of greater advantage to Canada from the viewpoint of steady national progress than the construction of even transcontinental railways. The construction of transcontinental railways drew great armies of immigrants from Italy and other countries of Southern and Central Europe. They were not farmers or farm labourers but unskilled industrial workers for the most part. When the line was constructed, although it had opened up very profitable farming regions, a great proportion of those labourers drifted back to Europe or over to the United States. Most of them had neither the means nor the inclination to take up land. The railway construction period was followed by a depression which was accentuated by the loss of this temporary immigration. The advantage of this St. Lawrence development, as compared with the construction of transcontinental railways, will be that the industrial workers used in the construction of the power and navigation works will progressively be absorbed into the manufacturing expansion which should follow the development of the power.

As regards the anticipated effect of the St. Lawrence Deep Waterway on Canadian railways, I personally fail to perceive wherein they may be robbed of any valuable traffic. The Waterway should increase traffic on lines west of Fort William which are not subject to water competition, while the lines east of Fort William are subject to this competition anyway, except during the winter when the same conditions would prevail after the Deep Waterway is completed as before. Not only ought they to profit by the increased traffic which inevitably comes in a period of large-scale construction, but after it is over from the augmented traffic resulting from the manufacturing expansion based upon power. Evidence produced at the Freight Rates Enquiry of 1927 showed practically an even distribution of ten tons of originating traffic per capita in every province of the Dominion. If this simple principle were applied to the anticipated increase in population resulting from the power, the result indicates a wide margin of gain rather than loss to the railways.

Right Hon. Mr. GRAHAM: But is there not a vast difference as far as the railways are concerned, in the value of the traffic? While the traffic, in tons, may be the same, the profit to the railway differs very materially on account of the freight classification as to rates; 10 tons of freight in one place may bring twice the revenue to the railway that 10 tons of freight would in another place, of another kind?

Mr. GOFORTH: Quite true. And if all new traffic of a railway were to belong to the lower classification, it would mean that ultimately even its fixed charges would not be covered, for bulk commodities are only expected to pay a very slight margin over and above the out-of-pocket cost of carrying the goods. The balance is made up from traffic of the higher classifications. As a general rule however, a traffic density is a fairly reliable financial thermometer of a railway. In the construction of the navigation and power works on the St. Lawrence there will be both high-grade traffic in the form of machinery, structural steel and cement, and low-grade traffic in sand, gravel, etc.

The real point at issue as regards the Canadian National Railways is that of attaining as soon as possible, that full state of solvency when its net receipts will pay the carrying charges on all advances ever made to it. This state has not yet been reached, and it would seem preferable to provide the immediate stimulus necessary to achieve commercial solvency, in the form of a major construction project as that under consideration, than to permit the accumulation of annual deficits to still further increase its burden of obligations. The construction period should occupy from 8 to 12 years for both power and navigation works, and this should be a means of tiding over a critical period in the progress of this great railway venture of the state.

The Committee then adjourned to the call of the Chairman.

MINUTES OF EVIDENCE

WEDNESDAY, 30th May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River met this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

Professor W. W. GOFORTH, of McGill University, was recalled and testified as follows:

Prof. GOFORTH: There are just three further points that I would like to add to my evidence of yesterday. I will just run over them with your permission, Mr. Chairman.

In connection with the factor of population and immigration there appears to be a distinct contradiction to the statement which I made yesterday, and which has been made before by an Honourable gentleman of the Senate, that hydro-electric power development implies a definite rate of population growth in and of itself. During the past seven years, that is, since 1921, we have had more than a doubling of our electric supply and by no means a similar increase in population. During the period 1921 to 1924, we actually suffered a net loss from immigration minus emigration, although there was a very rapid extension of our electric facilities. Even since then, although we have had a net gain from immigration and emigration of at least 200,000, yet this by no means meets the claim that there would be automatically a very large increase in population. When I discussed this point recently with Mr. R. H. Coats he expressed the same opinion that I had reached from analysing the drift from rural to urban centres; that the population requirements, the labour requirements of industry, founded upon this new development of electricity, had been drawn not from immigration but from rural areas, chiefly due to the collapse of agricultural prices after 1920, when wheat prices as an indication of the general movement fell from around \$3 down to below \$1. This condition caused a great flight from the farming areas to the industrial centres or even abroad. It is my opinion that the flight would have been far greater, would have taken the form of a much larger emigration from the country, if it had not been for the sapping up of the surplus labour by the industrial centres, founded upon the power. The drift from rural areas—and Mr. Coats expressed a similar opinion in a recent conversation I had with him, several weeks ago—the drift from rural areas has been definitely checked with the restoration of more attractive prices for agricultural products. A definite reaction has already begun to set in, partly due to the recovery of agricultural prices and partly due to the desertion of a great many farms which were potentially profitable to operate, and we cannot expect any further to draw from rural areas the labour requirements of industrial centres. It is my considered opinion that future industrial labour requirements will to a great extent have to be supplied from immigration, coupled with the retention of our natural increase which has roughly averaged fifteen per cent per decade since Confederation. There is substantial evidence to show that the anticipated requirements of land settlement are greater than the ability of rural areas to supply them by natural increase.

Hon. Mr. McDougald: What would have happened if the requirements had not been met by people coming from rural districts into urban centres?

Professor GOFORTH: There would have been a more serious emigration condition than we actually suffered from 1921 to 1925, a slower recovery from post-war depression, and possibly a prolonged era of abnormal unemployment.

Another feature of this immigration situation which I anticipate as a result of the St. Lawrence Deep Waterway and its by-product of power development, is the more assimilable and therefore the more desirable type of immigrant which should be attracted by the species of industrial opportunity provided, than in the case of transcontinental railway construction. The latter brought chiefly southern and eastern Europeans, while the electrical industries based upon St. Lawrence power should attract labour from those countries in which this class of industry has been most highly developed, namely from Scandinavia, Germany, Switzerland, Great Britain, and the United States.

Turning to still another feature of population, namely the problem of unemployment, I am of the opinion that the industrial development anticipated from the St. Lawrence project would tend to ameliorate our very serious seasonal unemployment. It is now generally accepted that this exceptionally high seasonal unemployment discourages immigration, especially when this perennial problem of Canada is almost unknown in the United States. They of course have had their occasional pits of depression, but not the steady annual fall of employment from 10 to 18 per cent which we suffer every December. Now this situation has been more acute in the centres of predominantly agricultural and commercial activity than in strictly industrial centres. This is easily understood as regards agriculture because of the highly seasonal nature of crop farming. In cities like Montreal, which suffers about the highest ratio of unemployment of any centre in Canada, the prevailing activities are those of a port which is closed for five months in every year, rather than of manufacture. Industrial activities provide a more regular and satisfactory employment of labour. It is my opinion, therefore, that the industrial development resulting from the power of the St. Lawrence, will provide a means of reducing this large percentage of unemployment which exists during nearly every winter period, not only in Montreal, but in other parts of Canada.

In connection with this immigration problem and the problem of attracting immigrants by giving regular employment. Professor Gilbert Jackson, who has made a very careful study of this question, and who besides being on the staff of Toronto University is also the economist of the Bank of Nova Scotia, showed me his very carefully prepared monthly chart of immigration during the post-war period. He shows that the peak of immigration comes about three months too late in every year to give a sufficiently satisfactory period of prospective employment to the immigrant. The peak comes at the end of July or the beginning of August, instead of coming in May. The labourer gets only his harvest period of a few weeks before he finds himself out of employment. This late peak, which results from abnormal agricultural demand for labour during the latter part of the summer, is a serious discouragement to immigration. If the stimulus to immigration were industrial rather than agricultural the peak would be reached earlier, and therefore provide a longer period of employment to the immigrant after landing.

Finally I would like to dispose of the question as to whether agricultural expansion in the Canadian and American wests would depress the wheat markets of the world. It has been claimed that the induced agricultural progress in both the American and Canadian grain belts which would come from the construction of the St. Lawrence waterway and the deepening of this outlet, would only cause an increase in the supply of wheat and the collapse of wheat prices, a situation as disastrous and far-reaching in its effects, as that which existed after 1920. This is not in accordance with expert evidence. In this connection I would like to quote from, I think, one of the best authorities on agricultural markets and on population growth, Mr. A. O. Baker, the Economist and Statisti-

cian of the United States Department of Agriculture, whom I met last summer at Honolulu. He stated that the world's population is increasing, in spite of such exceptions as France, at the rate of from 20,000,000 to 25,000,000 a year and that in practically all except Anglo-Saxon countries there is a definite rise in per capita wheat consumption. He said that in the United States, as distinct from all others, there is an actual decline in per capita consumption of wheat. His claim is that, after a certain standard of living is reached the average civilized community tends towards more expensive foods like fruits and meats rather in the direction of bread and wheat products. So the prospect of the United States' supply of wheat being kept for local consumption and not being sent into the markets of the world is much less than is generally imagined, and any agricultural expansion in the American West will tend only to increase its shipments of wheat to world markets, predominantly the European market, which absorbs about 85 per cent of the available world's surplus.

Hon. Mr. CASGRAIN: You do not agree with James J. Hill? You have heard of him?

Prof. GOFORTH: Yes.

Hon. Mr. CASGRAIN: He said there would be no wheat shipped out of the United States in twenty-five years. It is a long time since he made that statement. You do not agree with him?

Prof. GOFORTH: No, I am afraid I do not, nor does Dr. Ritter who is probably better informed on that subject than anyone living to-day.

Hon. Mr. CASGRAIN: But James J. Hill knew his business.

Prof. GOFORTH: Yes, there are certainly differences of opinion on the subject. It is my opinion however that most probable future tendency of wheat markets is a more rapid growth of demand than the great wheat producing countries will be able to supply. In other words the probable tendency of wheat prices is upwards over a long period, and that any agricultural expansion in the Canadian West will not result, except possibly for a brief period, in any depression of markets.

By Right Hon. Mr. Graham:

Q. Mr. Chairman, I would like to ask a question. Perhaps Professor Goforth made a statement on this point when I was not in. What effect will the St. Lawrence waterway development have on the Port of Montreal?—A. I think, several effects.

Q. Will it have a beneficial or a detrimental effect?—A. I think most emphatically a beneficial effect. I have examined this question with a desire to discover any harmful effect that may result from the completion of the St. Lawrence Deep Waterway but I can see no possible harmful effect. Of course there have been statements made that the dams and weirs that are constructed may collapse, as they did in California recently, and that Montreal might be wiped out in the terrific flood which would sweep down the river; but that is something which, not being an engineer, I would have to leave to others to decide. I do not think however that in a matter of such vital importance as this any such danger would arise. I have been informed by engineers that the actual cause of the California disaster was the very weak foundations which were laid and the soluble type of rock employed which gradually disintegrated into mud and undermined the whole structure.

Q. This is what I wanted to get definitely, because it is one of the things that are prominent in the discussion. The dam is a kind of auxiliary reason. It is contended in some quarters very strongly that it will injure Montreal in a financial and commercial way. Of course I have never thought that myself: that is the reason I asked that question very pointedly. Now, I have five or six impressions, and you will please check me up if I have got them wrong. News-

papermen always condense if they can. From what you said, Professor, I draw these conclusions. You favour the development without delay? You have given the reasons yesterday.—A. Except the delay involved in making a treaty which will protect the full rights of Canada from any possible “misunderstanding” by the United States.

Q. But I am speaking from the commercial view of it.—A. Yes.

Q. You believe that power will be required in Canada as rapidly as it is developed?—A. Except when it is developed at excessive cost. In other words, if it were developed at \$500 a horse-power I would not say that it would be required.

Q. No, but everything being reasonable?—A. All other things being equal—yes.

Q. I think you said that you favoured the power house which would, if possible, provide for the distribution of power in Canada—which would be on the Canadian side of the line.—A. For our share of the power, yes.

Q. That is what I say—the power being distributed in Canada. Another impression I received was that you do not believe that ocean liners will go west of Montreal, but tramp ships may.—A. Yes, that is my opinion.

Q. That rates on grain from Fort William to Montreal will be reduced from 4 to 5 cents per bushel?—A. Yes.

Q. As a result. That it will benefit rather than be detrimental to Montreal?—A. Yes.

Q. It will be an incentive to immigration of a superior class?—A. Yes.

Q. I got these impressions.—A. And one further point, that it would tend to ameliorate seasonal unemployment which has always been a serious problem in Canada.

Q. One of our difficulties, too, in our immigration to the West, is that we have not yet got to the point where the farm hands are generally engaged by the year. They have only their seasonal employment, and when the season is over, this is the reason——

Hon. Mr. L'ESPERANCE: That they go to Europe?

Right Hon. Mr. GRAHAM: —they flow into the States.

By Hon. Mr. Murphy:

Q. How will this equalize employment?—A. Because manufacturing industries are not subject to the same fluctuations in labour demand as activities connected with agriculture, trade and transportation. Montreal for instance with its activities at present based largely on transportation cannot support as regular employment of labour during the period of closed navigation, as it could if it were more predominantly an industrial centre. In other words the manufacturing expansion which promises to be the most important result of the St. Lawrence improvement would tend to smooth out the present marked seasonal fluctuations in employment.

By Hon. Mr. Casgrain:

Q. You spoke yesterday of tramp steamers. How long do you figure it would take a tramp to go from Liverpool to Fort William and back?—A. That is quite a question.

Q. Surely you can give us the figures. You ought to know that. That is elementary.—A. I do not think it is either a very fair or a very relevant question. For instance it would depend upon the speed of any given tramp steamer—

Q. You ought to know what the speed of a tramp is.—A. Eight to ten knots an hour.

Q. How many days would it take from Liverpool for the round trip?—A. I would have to do a little mental arithmetic.

Q. It would take fifty days.—A. Approximately.

Q. Tramp steamers, you say, will come in the future; they do not come now. That is a new element that would be brought in.—A. Yes.

Q. They do not come in now because there is no money in it. You think there would be more money?—A. There should be more money, because there would be greater assurance of cargoes each way.

Q. They will not get it.—I think there is abundant reason for believing that they will get it.

Q. Do you know of any port in the Great Lakes that would receive the full cargo of a ship?—A. If you mean of sufficient industrial and commercial importance I would say there are several. The 2nd, 4th and 6th largest cities of the continent are Great Lakes Ports,—Chicago, Detroit and Cleveland. As for harbour capacity and terminal facilities again there are several, including Toronto which is enlarging its facilities to accommodate vessels up to 29-foot draft.

Q. Do you believe that big canals can do the work as cheaply as small canals— A. As a general rule yes.

Q. —not making any allowance for their cost?—A. No, if the increased capacity of a canal could only be attained at prohibitive cost, and without equivalent gains in greater traffic and lower costs of transportation then it would be preferable not to build it.

By Hon. Mr. McDougald:

Q. Would you please say what effect the deepening of the waterway would have on the railway systems?—A. Yes. In the first place the railways should gain by increases in grain traffic from western points to Fort William, which should result from a cheapening of transportation. Secondly, with regard to eastern grain haul, which is even now subject to water competition, and on which the net return is necessarily small, little if any traffic will be diverted because it is chiefly a matter of winter, late autumn, or early spring haul anyway. Thirdly, the railways should profit greatly by the increased industrial traffic emanating from the central provinces, if the power resources of the St. Lawrence are developed. This traffic should chiefly consist of better class commodities of higher rate classifications. Fourthly, there would unquestionably be both a direct and indirect increase in traffic of all classifications during the long period of construction. This should prove especially beneficial to the Canadian National Railways which would thus be able to hasten the obliteration of annual deficits, which would otherwise accumulate to form a heavy additional burden to its present large capital obligations.

By Right Hon. Mr. Graham:

Q. You think that the next ten years will be the critical time?—A. The critical time.

Q. The time when they will have to "get over the hump"?—A. Yes, rather than pile up a \$40,000,000 deficit each year and have that much heavier carrying charges at the end. Apart from that, the industrial development resulting from the waterway and power development would in my opinion amply compensate the railways for any deficit or any loss which may result from grain traffic being diverted to the waterway. At the present time the Canadian National Railways, I am informed, only make, over and above actual out-of-pocket costs, \$200,000 on the grain traffic going eastward from Fort William and much of this is winter haul, unaffected by the waterway. This doubtful loss of \$200,000 over and above out-of-pocket costs of hauling the cars and bringing them back again, would not be of any consequence as compared with traffic gains of a higher classification coming from industries based upon the power, and from development in the West resulting from savings in transportation on the St. Lawrence waterway.

By Hon. Mr. Smith:

Q. I was not here yesterday afternoon, and I am much interested in Senator Graham's synopsis of his impressions. In regard to the saving of 4 or 5 cents in carrying a bushel of wheat from Port Arthur, I cannot ask you to go over the reasons, but it appears to me like this, and I would like you to check me up. If the Welland canal is finished and the upper lake boats can bring wheat down to Prescott, the saving would be the difference between the cost of carrying a bushel of wheat by the deep waterway, in a big upper lake boat, from Prescott to Montreal, on the one hand, and on the other hand the cost of carrying it from Prescott to Montreal by some other cheap-as-possible method, either canal boats or barges or rail. It seems to me that would be the saving, whatever it is, if there is any. Now, isn't that correct?—A. No. I would like to amend that, if I gave such an impression. I worked out this saving of from 4 to 5 cents per bushel as an anticipated result of the Deep Waterway when compared with the present system of transportation on the St. Lawrence. That is excluding the Welland canal except as a contributory cause of the saving indicated.

By Right Hon. Mr. Graham:

Q. As of to-day?—A. As of to-day.

By Hon. Mr. Smith:

Q. Why not compare it with the condition which will exist when the Welland is finished? That will be in a year or so.—A. I stated that there would be a reduced saving of 2 cents per bushel if Prescott is made the terminal instead of Port Colborne. In other words the saving per bushel on a deep waterway for through navigation of large lake steamers would approximate three cents as compared with transshipping at Prescott.

Q. Now, when a boat comes down to Prescott with a load of wheat and by the deep waterway goes through to Montreal, how much do you estimate that it would cost for that boat to take that load down to Montreal and come back empty?—A. It would not necessarily come back empty.

Q. Supposing it did.—A. There is quite a large package freight going from Montreal up the waterway even now.

Q. But in these various calculations of these different gentlemen who have been here they figured that the easiest and safest method would be to estimate that the vessel went back empty.—A. Not all, I think, for both Mr. Ferguson and Mr. Harvie emphasized the importance of incoming traffic by more favourable differentials against American Atlantic ports and rail haul. Mr. Ferguson specifically mentioned the case of a large shipment of potash from Germany to Cleveland via Montreal, which would ordinarily go by Baltimore.

Q. I have no doubt of that.—A. It was stated that the construction of the Panama canal did not bring about a full realignment of traffic in a year or even ten years. It has taken fifteen and will probably take twenty-five years to accomplish a full realignment of traffic from previously established routes.

Q. But confining it to this question of wheat and the saving on the cargo?—A. Yes.

Q. You have an upper lake boat with 500,000 bushels of wheat at Prescott. Now, it is going to cost that boat something to take it down to Montreal and come back again.—A. Yes.

Q. Have you any idea or estimate of what that would cost?—A. I would not care to make a statement on that point.

Q. It would be something, I think.—A. Yes, of course.

Q. They would not do it for nothing. On the other hand, if the grain is put into an elevator, then it will be taken from the elevator by the present canal

boat or barge, or by rail. Have you any idea of what that would cost?—A. I am not prepared at present to submit estimates on such alternative methods.

Q. Would not the difference between those two costs be the whole and entire saving in bringing a bushel of wheat down from the upper lakes—where can there be anything else—after the Welland Canal is finished, or if boats can come down to Prescott whether the Canal is finished or whether it is not?—A. From the viewpoint of wheat alone the difference in saving either way would not seem to be a very material consideration; but I think the whole hypothesis of a broken route—broken at Prescott and Montreal—ignores the other factors of gain which arise from a deep waterway, evenly developed throughout its course from the head of lake navigation to tide water.

Q. I quite agree with you there, but I am confining the question to wheat alone. That is all I was discussing.—A. One of the points which I think is suggestive of saving to the people of Ontario, especially eastern Ontario and markets to the Maritime Provinces, is the possibility of Nova Scotia bituminous coal competing with coal coming from the Erie ports. The large colliers now coming to Montreal bringing the greater proportion of that city's bituminous supply from Nova Scotia, as indicated by the report of the Montreal Harbour Commission this year, would undoubtedly be able to go further up the St. Lawrence if the channel and locks permitted.

Hon. Mr. McDougald: I may say that the Montreal Transportation Company had an elevator, and they used it to transfer grain from the upper lake boats to the boats at Prescott and barge it to Montreal. Now there is not a barge on the Montreal route at the present time; the steamboat has taken the place of it.

Hon. Mr. Smith: I did not say barges; I said to carry it the cheapest way. One route would be by rail from Prescott, another by boat, and the third by barges. Whatever would be the cheapest way would soon be found out in commerce. I am not objecting to the canal; I am not saying where I stand on this question at all. It is only in regard to wheat. This statement will go out to the public press, on your authority, that there will be a saving of four or five cents a bushel in bringing wheat down from Port Arthur.

Prof. Goforth: That is, compared with the present system.

Hon. Mr. Smith: I do not think we should consider the present system at all. The Welland Canal will be finished in a year or so, and when it is finished the upper lake boats can come down, and Prescott will be practically eliminated.

Right Hon. Mr. Graham: But in order to get to Prescott there must be quite a large expenditure in this St. Lawrence development, in order to make the channel fit for the larger boats as far east as Prescott. The work has to be started to that extent. Of course I agree that it would not be absolutely necessary to go further than that.

Hon. Mr. McLennan: There is a question whether Kingston could not be utilized.

Hon. Mr. Murphy: In regard to what Senator Smith has said, the witness says he is not prepared to answer.

Prof. Goforth: No.

Hon. Mr. Murphy: But Senator Smith's statement should not go out in the general way in which it has been made.

Prof. Goforth: In my statement yesterday I said that the Oswego-Albany water haul would be practically equivalent to this proposed barge haul between Prescott and Montreal; and if the desire on the part of Canada is to retain her wheat traffic, there would be more advantage, seemingly, in having an unbroken outlet rather than having one which is practically equivalent to the Oswego-Albany route.

Right Hon. Mr. GRAHAM: Sir William Van Horne on several occasions tried to impress upon me the fact that grain could be carried more cheaply to Montreal if it were taken to Prescott or some point there and re-shipped in barges, even if the canal were developed. There was this point that was not so much in evidence in Van Horne's time—the question of power development in connection with navigation. He was only discussing the question of navigation. Vessels have grown to so much greater size and tonnage during the past few years that perhaps his opinion at that time would not be his opinion if he were here to-day.

Prof. GOFORTH: I think it is also necessary to emphasize the fact that in connection with the St. Lawrence development, there will be a greater proportion of open river and almost open lake navigation in large sections between Lake Ontario and Montreal, than under present conditions. The whole river section above Barnhart island, if it is a single stage development, will be substantially deepened and even widened as a result of the proposed damming at that point. Again from Cornwall to Melocheville if the Beauharnois alternative plan is adopted, there would be practically no restrictions to rapid navigation. Below Melocheville navigation will be benefited by a better maintenance of levels on Lake St. Louis than is now possible without controlling weirs at Valleyfield and Lachine. All this would seem to indicate little extra cost of operating large lake vessels right down to Montreal.

Hon. Mr. McLENNAN: I am interested in any statement that goes out to the press. It ought to be very carefully indicated that the figures given by this and other witnesses are on the basis of cost, not on the basis of rates.

Prof. GOFORTH: I stated that yesterday; it is a question of cost.

Hon. Mr. McLENNAN: I think that should be emphasized, in putting anything out.

The CHAIRMAN: Of course we will ask the professor to carefully revise his manuscript before it is printed. We do that in all cases.

Hon. Mr. McLENNAN: It would be a good thing to emphasize that point.

Prof. GOFORTH: I shall do that when revising the transcript of my evidence.

Hon. Mr. REID: We have had evidence between Montreal and, say, Prescott and Kingston, or Port Colborne—the three. If we could get a man like Matthews, or some man that is in the business, it would be a good thing.

Mr. GOFORTH: I think Mr. Leslie Thompson, whom I mentioned yesterday, would be in a position to supply the information.

Hon. Mr. REID: We should have some men that are operating vessels from Montreal to Port Colborne; a Canada Steamship's man, if he is coming.

The CHAIRMAN: We have enquired of Mr. Matthews, and he will come on Tuesday. I was in conversation with the Canada Steamship Company representatives this morning, and they do not feel that they are ready to come before the Committee.

Hon. Mr. SMITH: I would like to have Professor Goforth send a statement showing, as nearly as possible, the cost of bringing wheat down to Prescott or Montreal in upper lake boats, and the cheapest other method.

Mr. GOFORTH: I shall be glad to prepare and file such a statement.

The CHAIRMAN: On behalf of the Committee I thank you very much, Mr. Goforth.

WEDNESDAY, 30th May, 1928.

Mr. MALCOLM NEIL GILLIES, Canadian Marine Superintendent of the Anchor-Donaldson Line, Montreal, was called, and testified as follows:—

The CHAIRMAN: Now, Mr. Gillies, will you just tell us what you know about the navigation between Montreal and the upper lakes?

Mr. GILLIES: Well, Mr. Chairman and gentlemen, I am dealing with liner tonnage entirely. That is what I am accustomed to. We have passenger liners of 14,000 tons, and freight liners running from 8,000 to 10,000 tons. Our passenger liners and freight liners on the Glasgow service make the round trip, out Montreal to out Montreal, in 28 days. The period of navigation for the St. Lawrence, we will say from the 5th of May to the 25th of November, is about 205 days, and we make seven voyages. Our first ship will make eight voyages in the season, that is, twenty-eight-day run. We turn the ships round in a matter of three or four days, with good facilities in Montreal, provided cargo is ready on arrival; but we sail with or without cargo on schedule dates, with grain, package freight, cold storage and Canadian and American produce of all kinds. Now, we will take the question of ocean steamers going inland—say Toronto.

We cannot go only to a grain port; we want general cargo.

Our import cargo from Glasgow will be about 1,000 tons on the west bound trip. The heavy grades of cargo—structural steel, plates, bricks, and also some package goods—must be landed in Montreal. The package goods for the West of course could be carried on to Toronto if the consignees would allow it; but take, for instance, Eaton's (we carry quite a lot of goods for Eaton's) they can't get delivery quick enough; we have to stow these on top, and land them immediately the ship docks in Montreal, then railed to Toronto fast freight—about twenty-four hours. I merely mention that to inform you gentlemen that the ship must stop at Montreal first. That means a matter of two days' delay there. Then, east bound, we have to take care of our flour shippers such as Ogilvie's, St. Lawrence, Dominion, and lift their commodities at Montreal, which are booked away months ahead, and that cargo is all delivered at our sheds there. That means that we have to have shed accommodation at Montreal as well as in Toronto. (We are leaving Toronto as the final port.) That is an extra expense (like two ports against our present one port). We would be two days each way at Montreal; that is four days longer than the average.

Right Hon. Mr. GRAHAM: That is, if you only went to Toronto?

Mr. GILLIES: I am only taking Toronto; I am only giving that as a central point for assembling cargo. Cargo has to be assembled to give dispatch to a steamer at one point.

Right Hon. Mr. GRAHAM: And a distributing point as well?

Mr. GILLIES: Yes, and you cannot keep the schedule date unless you have your cargo assembled as well as possible on arrival, else it would be impossible to keep up the schedule date. Now, we will say to Toronto. I understand that there are to be about nine locks, and on ships to go there we will not get a minimum insurance. Our ships are not constructed for canal work, and it would mean that they would have to be stiffened longitudinally to take the buffeting with beam winds, and so on, in the canals, and also require to be assisted by tugs in taking the lock entrances. That would mean considerable expense to go up there. We will take three and a half to four days Montreal-Toronto. (We won't count the time loading in Toronto, because that time would be occupied in Montreal just the same—as one port) and the same time down. It would mean about twelve days that the ship would be in inland waters, which would mean about 100 per cent increase in insurance which you have got to cover for the time steamer is west of Montreal, say twelve days Toronto voyage.

Hon. Mr. McLENNAN: How much?

Mr. GILLIES: About 100 per cent, roughly; I have not gone into the figures of increase in insurance. Now, there is eight days' coal consumed in addition to ordinary voyage, plus the port use four days; and then in order to ship maximum cargo at the limited draft of water in this channel (I understand that twenty-seven feet is what is proposed) you should also, if possible, have the channel thoroughly swept to allow draft of about 24 feet 6 inches or 25 feet.

In the St. Lawrence we allow 2 feet 6 inches under the ship's bottom, but if it is a swept channel it might be managed with two feet.

That would mean we would cut down our bunkers so as to allow the ship to carry as much cargo as possible from Toronto down to Montreal, and rebunker at Montreal for the passage across the ocean.

Now, we are in the habit of bunkering for the round trip at Glasgow, where coal is about \$4.50 a ton, and at Montreal it is \$7.40 for the long ton; so about 500 tons that we have to take at Montreal at \$3 a ton more is additional cost against Toronto voyage. This is a differential that has to be covered on that inland water voyage. Then there is the time. In 28 days we make the round trip Montreal, but it will take us 40 days the round trip Toronto; that is, we would lose two voyages in a season of 204 days. Now, for these five voyages there would have to be extra earnings to cover the earning power of the vessel in the given seven months, seven voyages Montreal only against five Toronto. I think, gentlemen, I need not go into small figures, the cost and extra weight of the vessel; what I mean by that is, extra stiffening, longitudinally, and so on, would cut down our normal trade earnings of, say an 8,000-ton vessel. It would cut it down about 400 tons, at say \$4 a ton; there is \$1,600 a voyage for the whole twelve months. All that has to be figured on by the ship owner, and he must get the earnings before he will go. On those grounds, I don't think that the liners of the class I have mentioned, which is the first-class liners, will go any further than Montreal.

Hon. Mr. REID: About what tonnage?

Mr. GILLIES: 8,000 to 10,000.

Hon. Mr. REID: They won't go west of Montreal?

Mr. GILLIES: No.

Hon. Mr. McLENNAN: What is your east bound cargo on the average? you said you had about 1,000 tons west bound?

Mr. GILLIES: West bound, yes.

Hon. Mr. McLENNAN: And about what east bound?

Mr. GILLIES: We lift 6,700 to 7,000 tons.

Hon. Mr. McLENNAN: That would be a full load?

Mr. GILLIES: A full load, yes. It all depends on the cubic contents of the cargo. We perhaps take half grain, and the rest package freight. Grain only does not pay. We have to take package freight.

Hon. Mr. REID: What is the size of this vessel?

Mr. GILLIES: The one I mention, 415 feet long and about 55 foot beam.

Right Hon. Mr. GRAHAM: I suppose we can take it for granted that, while you have taken Toronto as a sample, the further inland you go the stronger would be the sample?

Mr. GILLIES: The more cost, the more we will have to get for our trip; and I reckon, roughly, that to go to Toronto we have to be compensated for the loss in the earnings of that vessel, of two voyages less to Toronto than Montreal, and our standing charges for twelve extra days—that is, management and everything—our extra insurance on inland waters, our extra coal consumed, it would require 75 per cent more earnings on each of the five voyages to Toronto than we get in Montreal trade on seven voyage basis, to equalize.

Hon. Mr. MURPHY: You say you lose two voyages?

Mr. GILLIES: Twenty-eight days going to Montreal, as against forty days going Toronto.

Hon. Mr. CASGRAIN: Seventy-five per cent more cost?

Mr. GILLIES: No; more revenue for the five voyages.

Right Hon. Mr. GRAHAM: I do not think we need to emphasize it any further. You do not believe that the larger boats particularly will go west of Montreal?

Mr. GILLIES: As far as passenger boats, they would never dream of it.

Right Hon. Mr. GRAHAM: And freight liners not likely to?

Mr. GILLIES: Not fast freight. Of course there is nothing impossible. You give a tramp steamer an inducement and he will go anywhere you want him to go, provided you pay the costs.

Right Hon. Mr. GRAHAM: I mean as a regular thing; unless there is something special, they would not go west on a regular competing rate?

Mr. GILLIES: They would not go. You must make earnings. Then if you get a cheap vessel to go up there, the shipper is going to shout, because the insurance will go up. The shipper has to have a first-class vessel or the insurance on his cargo will go up.

Hon. Mr. McLENNAN: Does your inland cargo go west from Montreal by water now?

Mr. GILLIES: Quite a bit. Well, Ontario takes all the whiskey up that way. Often goods go by rail, such as Eaton's goods; you can't get them away quick enough.

Right Hon. Mr. GRAHAM: Quite a lot of package freight goes by slow freight, along the towns.

Mr. GILLIES: As a rule those goods are scheduled with a through rate, lake and rail.

Right Hon. Mr. GRAHAM: In our town I think recently we shipped quite a lot of goods to western Ontario by boat, because it was much cheaper at the time. I suppose it is safe to say, without any discussion—I am not trying to convince myself, because I have been convinced a long while—that the development of the St. Lawrence waterway will be taken advantage of, not by ocean liners, but by larger lake boats going through to Montreal.

Mr. GILLIES: That I can't say. I don't know much about the lake boats, but I don't see how they can do it without return cargoes, and the only way they can do that is to get freight both ways.

Right Hon. Mr. GRAHAM: To come to the gist of what I was going to ask you, what I was leading up to, in your opinion will the development of the St. Lawrence west of Montreal be injurious to Montreal in any way?

Mr. GILLIES: Well, that I can't say, but one thing I know is that we have trouble every season in regard to the water level, and I hope we will have none this year, the water is so high just now. When I came out here first, nineteen years ago, we used to have what we called the Ottawa rise, the end of June, and that gave us another rise after April, and that continued until about 1912 or 1913, but now with the Ottawa Valley being all stripped, the sun gets at the snow right away, and we get the one rise, and that is the finish. Then we have to depend on the eastern winds in the gulf, and the rain, for the rise of water in the St. Lawrence.

As the villages and towns along the St. Lawrence increase, and the population of the country increases (I am only talking as an old sailor observing things since being in Canada) I think the day will come when we will have to think

about damming the St. Lawrence about ten miles above Quebec, where we have a sixteen-foot rise and fall, to hold the water for Montreal, Three Rivers, and possibly Sorel.

Right Hon. Mr. GRAHAM: The sixteen-foot rise, that is the tidal rise?

Mr. GILLIES: Yes; so we better keep some money to look after that part of it, in my opinion.

Right Hon. Mr. GRAHAM: But if they should develop power the province will look after it.

Mr. GILLIES: Well, that has got to be thought of, and there is money wanted for that, because it will have to be a big dam to stand ice pressure, and there will have to be big gates about 400 feet wide to allow the ice to go out in the spring.

Hon. Mr. CASGRAIN: You have been all your life at sea, that is to say, in navigation?

Mr. GILLIES: More or less since I was sixteen years of age. Now I have been nineteen years on shore end.

Hon. Mr. CASGRAIN: But in the shipping business all the same?

Mr. GILLIES: Yes.

The CHAIRMAN: Captain Gillies, we are gratified to have you come up, and thank you for your evidence.

The Committee then adjourned until to-morrow at eleven o'clock, in the forenoon.

MINUTES OF EVIDENCE

THURSDAY, 31st May, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River met this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

Colonel A. E. DUBUC, Chief Engineer, Department of Railways and Canals, was called as a witness.

The CHAIRMAN: Colonel, the Committee is ready when you are.

Col. DUBUC: I am ready, sir.

Hon. Mr. McLENNAN: Do you desire to correct or amplify the figures in the last report of your department as to the volume of traffic, etc., on the canals?

Col. DUBUC: Well, I was really more concerned in the interpretation of the figures collected from the different canal offices and published by the Dominion Bureau of Statistics, Transportation Branch, Department of Trade and Commerce, in its pamphlet "Canal Statistics for the year ended December 31, 1927".

For statistical purposes, the main canal system from the Great Lakes to Montreal is divided into three sections: First, the Sault Ste Marie lock, connecting Lake Superior with the St. Mary's river and Lake Huron; Second, the Welland canal, connecting Lake Erie with Lake Ontario; third, the St. Lawrence canals connecting Lake Ontario with Montreal and comprising the Galops, the Morrisburg or Rapide Plat, the Farran's Point, the Cornwall, the Soulanges and the Lachine canals.

In the statistics as published, any boat that starts, say, from Fort William for Montreal is reported at Sault Ste. Marie—the boat itself and its registered tonnage and its cargo. All three are counted again as the boat goes through the Welland canal, and again as it goes down through the St. Lawrence canals. So if you are not careful in reading a table like the one, No. 39, at page 51 of the pamphlet, giving the traffic for a period of years on all Canadian canals, you may easily get a very misleading picture of what that traffic has really been, as a boat that has gone through the whole system is included three times in the totals as to number, as to registered tonnage and as to cargo.

There is no doubt, as I will prove by official figures later on, that traffic in our main canals has increased very materially, particularly since 1921. But if I wanted to try and prove, as some who should have known better have tried to prove, that our canals are dying and that traffic through them is decreasing, say, since 1913, I would use this table No 39 thus: I would first say that I am not interested in freight of American origin, and I would eliminate all such traffic from my compilation as if the treaty of 1871 and that of 1909 had ceased to exist. I would equally take into account only freight of Canadian origin passing through Canadian canals and leave out of reckoning all Canadian freight which out of convenience is using the American locks at the Sault. If I do that, I find from the table that, in 1913, the total freight of Canadian origin only and passing through Canadian canals only represented a total of 11,130,875 tons, whilst in 1926 the same class of freight passing through the same canals totalled only 9,656,190 tons, showing a decrease of 13 per cent,

which, if intended to prove that traffic in the St. Lawrence canals in the same period has decreased, is entirely wrong and contrary to facts, as I will prove later on. The table is not meant to be used that way as, instead of a decrease, and notwithstanding the war years and the following depression, there was in the same period in reality, on the St. Lawrence canals, an increase of over 102 per cent in cargo carried.

To the one trying to prove the decrease, the year 1913 is taken as a comparison because it is just the year before the Americans completed a big new lock at the Sault, the Davis lock, previous to which practically all freight of Canadian origin and a large proportion of freight of American origin passed through the Canadian lock, it being the largest and most convenient up to that time. As a matter of fact. I find, from table No. 40, that in 1913, 4,954,734 tons of freight of Canadian origin and 37,744,590 tons of freight of American origin went through the Canadian locks, a total of 42,699,324 tons, whilst in 1926 only 1,207,216 tons of freight of Canadian origin and 216,059 tons of American origin went through the same lock, a total of only 1,423,275 tons, representing a decrease of 41,276,049 tons.

Hon. Mr. MURPHY: Did you not say that you were eliminating all freight of American origin in the comparison you were making?

Col. DUBUC: I was, but only for the benefit of one trying to prove, notwithstanding the facts, that traffic in our Canadian canals was decreasing. In using the figures 11,130,875 for 1913 and 9,656,190 for 1926, I have wrongly eliminated all freight of American origin which, as long as the treaties of 1871 and 1909 operate, has the same rights and privileges in Canadian canals as freight of Canadian origin; and besides, I have neglected to take into account all the freight of Canadian origin (2,285,259 tons in 1913 and 8,338,239 tons in 1926) which at the Sault, under the same treaties, used the American locks instead of the adjoining Canadian lock. The reason for this diversion of traffic is easily explainable. The Canadian lock at the Sault, built in 1895, is 900 feet long, 60 feet wide, with 18 feet 3 inches of water on the sills. In 1913, the only American locks at the Sault were the old Weitzel, 515 feet long, 80 feet wide, with only 12½ feet of water on sills, closed in 1918, and the Poe lock, 800 feet long, 100 feet wide, with 18 feet of water on the sills. In 1914, the American Government completed the Davis lock, 1,350 feet long and 80 feet wide, with 24½ feet of water on the sills, and in 1919 opened the "Fourth" or "Sabin" lock alongside and of the same dimensions. It is understandable, in view of these larger, wider and deeper two American locks, all equally free of tolls, how nearly all traffic, both Canadian and American, was diverted to them in preference to the now smaller Canadian lock.

Right Hon. Mr. GRAHAM: In 1926 our traffic went through the American Sault canals to the extent of over 8,000,000 tons?

Col. DUBUC: Yes. In 1926, 8,338,239 tons of freight of Canadian origin went through the American locks, whilst in 1913, this traffic was only 2,285,259 tons, a difference of 6,052,980 tons in favour of 1926 which table 39 obviously does not take into account at all.

Hon. Mr. CASGRAIN: There is only one ton in ten that comes east of Lake Erie?

Col. DUBUC: For the present, I am speaking of the Sault only.

Hon. Mr. CASGRAIN: Yes, at the Sault, but we are interested east of Lake Erie, and there is only one ton in ten that comes east of Lake Erie?

Col. DUBUC: I am speaking of one who is wrongly interpreting table No. 39 in order to prove that there is a gradual decrease of traffic in the Canadian canals, and I say that to use that table in that way is absolutely misleading and in direct contradiction with the facts.

Hon. Mr. McLENNAN: And it is not proving anything. What actual facts can you give us now?

Col. DUBUC: If you want to consider the capacity of our main canal system between the Great Lakes and Montreal you must first find the point of greatest congestion. At Sault Ste Marie, you have four locks in full operation and a traffic capacity many times that which is available downstream. You may equally eliminate from consideration the Welland canal, as the new Welland Ship canal is expected to be in operation in a couple of years, and will be of a capacity many times that of our present system. That brings us down to the foot of Lake Ontario. Between there and Montreal, our observations show that the freest canal, the canal with the largest capacity is the latest built, the Soulanges, completed in 1900. Its capacity can be estimated at about 14,000,000 tons of freight per year, based on our experience and the way the traffic presents itself.

Hon. Mr. McLENNAN: That means that if the canal was continuously operated, it would carry 14,000,000 tons of shipping up and down; is that right?

Col. DUBUC: No. The theoretical capacity would be very much larger than that. I think we can assume that the Soulanges canal can actually take care of about 60 to 70 boats every 24 hours.

Hon. Mr. McLENNAN: This is the working capacity you gave us?

Col. DUBUC: A working capacity of about 14,000,000 tons, assuming the traffic presents itself as it does now. I mean with the slack summer months and the rush as it occurs nearly every year in the autumn and spring.

Right Hon. Mr. GRAHAM: If by any chance the traffic developed west of Soulanges, what traffic could be handled in its present state—present draft and length of locks?

Col. DUBUC: If you will allow me I will come to that in a minute. The Lachine canal, on account of many twin locks, has a capacity not very much below that of the Soulanges, so our weak point is not there.

Right Hon. Mr. GRAHAM: Twin locks mean greater lift?

Col. DUBUC: No, adjoining, in pairs. The first two locks up from the harbour of Montreal, where the main congestion occurs, are in pairs.

Right Hon. Mr. GRAHAM: That facilitates your traffic?

Col. DUBUC: It does. So the Lachine can be compared with the Soulanges with about 14,000,000 tons capacity. Now we come to the section of canals between Lake Ontario and Lake St. Francis, which is all in the international section. We find there are two weak links there, with a capacity appreciably less than at either the Soulanges or the Lachine—locks 15 and 17 of the Cornwall canal, and the Morrisburg canal. The main reason is that at Cornwall these two lower locks are nearly in flight, with very little pondage between, thereby rendering the feeding of water rather slow. There is equally a congested point at the upper end of the Morrisburg canal, caused by the difficulty at low water stages of getting in at the upper end on account of the short approach wall and the cross current, which at times causes a boat coming to that lock from upstream to turn its nose in-shore, drift along with the current and then turn slowly downstream towards the lock.

So, in order to ascertain what was the actual traffic at locks 15 and 17 in the Cornwall canal, I have had an abstract made from the canal records at our Cornwall office of all the lockages, registered tonnage and freight carried through those locks, since 1913.

You can calculate the traffic of a canal in three ways, I would say. You can do it by adding the registered tonnage of the boats that go through. That gives you some idea of what the traffic is, but it is not extremely accurate, as it

is immaterial to the man who operates the lock whether he must pass a big or a medium sized boat, he must take the time to lock the boat. I find that in 1913, the registered tonnage of the boats east and west bound going through lock 15 totalled 3,490,893 tons. In 1927 that total was 6,568,933 or an increase of 88 per cent over 1913.

Right Hon. Mr. GRAHAM: That is, in traffic?

Col. DUBUC: Registered tonnage of the boats going through.

Hon. Mr. McLENNAN: In both directions?

Col. DUBUC: In both directions, east and west.

Right Hon. Mr. GRAHAM: A boat goes through to Montreal, its destination?

Col. DUBUC: Yes, and any boat that comes down generally also goes up, as I find that for the eastbound traffic, the registered tonnage was 3,183,632, and for the westbound, nearly the same, 3,385,301, totalling the 6,568,933 tons I just mentioned.

Hon. Mr. CASGRAIN: Passenger boats are counted?

Col. DUBUC: Yes. The registered tonnage is practically the cubical contents available for cargo expressed in tons of 100 cubic feet to the ton.

Another way of finding the traffic passing through a canal is by weighing the actual freight carried. In 1913, there passed through lock 15, 3,470,928 tons of cargo. In 1927, this had become 7,023,808 tons, an increase of 102 per cent over 1913.

Even that is not a very accurate way of doing it. Time is lost and the boats must be let through whether they carry cargo at all or not. The more accurate and better way I believe is to compile the number of actual lockages made.

Right Hon. Mr. GRAHAM: This is eliminating the number of tons of freight carried?

Col. DUBUC: Exactly. I might add, relative to registered tonnage and freight carried, that as compared with 1913, the war created quite a depression which has remedied since. I find that in 1915, there was a decrease of 24 per cent in freight as compared with the previous year; in 1916 an increase of 1 per cent over the previous year; in 1917 an increase of 5 per cent over the previous year; in 1918 a decrease of 9 per cent from the previous year; in 1919 a decrease of 8 per cent from the previous year; in 1921 an increase of 33 per cent over the previous year and in 1927 a direct increase of 30 per cent over 1926. Practically the same percentages apply to registered tonnage. There was a decrease in 1915 of 20 per cent from previous year; in 1921 an increase of 27 per cent; and in 1927 an increase of 30 per cent over 1926.

Hon. Mr. BEAUBIEN: What are the figures for 1926 and 1925?

Col. DUBUC: 1924 showed an increase of 26 per cent in freight over 1923; 1925, an increase over 1924 of 12 per cent; 1926, a decrease of 4 per cent from 1925. But there was an obvious reason for that. It was just at the time of the coal strike in Great Britain, when the majority of tramp boats which used to come to Montreal to clear the elevators were not available. They found it more lucrative to bring coal from France and Germany, and things like that. So the grain remained stagnant in the different elevators, and the traffic did not come through the canals. The following year there was a direct increase of 30 per cent.

As to lockages at lock 15 I find that in 1913 there were 4,681.

Hon. Mr. CASGRAIN: How many days would that be? 230?

Col. DUBUC: Average 234—whatever the length of navigation season was each particular year. This makes an average of about 20 lockages per day. In 1915 there was a decrease of 11 per cent from 1914. In 1921 there was an increase of 11 per cent over 1920; an increase of 2 per cent in 1922; 1 per cent in 1923,

and 15 per cent in 1924, all relative to the previous year. There was an increase of 2 per cent in 1925; a decrease of 1 per cent in 1926, and an increase of 22 per cent in 1927, when the total lockages were 6,765 as compared with 4,681 in 1913, an increase of 45 per cent in actual lockages.

Now, what happened monthly and daily in 1927? I find that in the month of August, for example, there were 1,011 lockages, which represents an average of 33 per day. In September there were 986 lockages, representing 33 per day; in October 991 lockages, representing an average of 32 per day, and in November 815 lockages, representing an average of 27 per day. If I look at the beginning of the year I find that in April there were 221 lockages, representing an average of 28 per day; in May, 953, representing 31 per day; in June, 990, representing 33 per day, and in July 725, or 23 per day.

Hon. Mr. CASGRAIN: Did you say they could make 72 per day?

Col. DUBUC: No, sir, not here. I said nearly that relative to the Soulanges. The most that could be done through locks 15 and 17 of the Cornwall canal is probably 40 to 42 lockages per day, the almost maximum. I notice that on November 13th there were 48 lockages and on June 5th 44 lockages, but conditions were then unusually favourable with boats awaiting both upstream and downstream and no delay.

Hon. Mr. REID: How many lockages were there on the other locks in the Cornwall canal?

Col. DUBUC: Cornwall is the only point where we have a statistical officer recording the Cornwall canal.

Hon. Mr. McLENNAN: Are those figures illuminating? Do they help the present and future problem?

Col. DUBUC: They help in this way. If it has been proven to your satisfaction, from official records, what the present capacity of the main canal system is at the weak points, and you assume future increases from what has actually happened in the past, you may reasonably deduct when the ultimate capacity of those canals will probably be reached. You must equally not lose sight of the fact that the deep waterway will not be utilizable until 8 to 10 years after its construction is started.

With the last 6 or 7 years as a guide, it seems clear that even if you started the construction of the deep waterway to-day, long before you could complete it you would have congestion in the canals, and the present system would not be able to cope with the traffic that should offer.

Hon. Mr. McLENNAN: And we will lose traffic?

Col. DUBUC: Either it will be diverted to American ports, or else it may find its way down to the lower end of lake Ontario and then move by rail to Montreal at whatever extra cost this may be. It may equally be diverted by rail to Pacific ports or by boat to Georgian Bay ports and rail to the seaboard or by the new Hudson Bay route now under construction to Fort Churchill.

Now, you may ask, what is the capacity of lock 15? In 1927, the average for a long period of months was between 31 and 33 and when I say average I mean that if on a certain day, owing to adverse winds or other causes, the boats have been delayed and were not able to proceed through the canal, and you had only say 25 lockages, then the following day, in order to average, you would have to have 39 lockages. Thirty-two is the average for many months. If the capacity is taken to be around 42, it follows that lock 15, in 1927, was working then at a little over 75 per cent of its capacity.

Hon. Mr. CASGRAIN: How many minutes would it take to make one lockage?

Col. DUBUC: A little bit over half an hour.

Hon. Mr. CASGRAIN: That is right. Thirty-eight minutes.

Col. DUBUC: If it were half an hour, that would allow you 48 lockages per day.

Hon. Mr. CASGRAIN: Would it cost much to make the water come in more quickly? You can make a lockage in 9 minutes at the Sault.

Col. DUBUC: Actual filling there may take that time, but our records show that complete lockage takes a good half hour in average. There is much more than bringing in the water, Senator; there is the size of the boat in relation to the lock. At the Sault you have a 600 foot boat in a lock of over 1,300 feet, it comes in holus bolus and has lots of space to adjust itself in the lock.

Hon. Mr. McLENNAN: But this is a close fit.

Col. DUBUC: The locks of the St. Lawrence canals are 270 feet long—their useful length is about 254 feet—and 45 feet wide. The majority of the canallers are 253 feet long and nearly 44 feet wide, and there are only a few inches to spare between the boat and the gates or the side walls, so you can see how delicate an operation it is.

Hon. Mr. McLENNAN: And the lift is more than at the Sault, isn't it.

Col. DUBUC: No. The Sault is 20 odd feet, and lots of the St. Lawrence locks have only 12 to 15 feet lift.

But there is another point. At the Welland Ship canal, for instance, the inflow of the water is through a big tunnel along both sides of the lock, feeding little tunnels on each side of the boat, thus not disturbing the boat in the centre of the lock. In the St. Lawrence canals the water is let in through sluices at the bottom of the upper gate or at one upper end of the lock, thus creating much disturbance and some delay in operation.

Hon. Mr. MURPHY: When you said there were only so many lockages in a day at Cornwall, in view of what you have said, that means a period of 24 hours?

Col. DUBUC: Yes, sir, night and day, Sundays included from the opening to the closing of navigation.

Right Hon. Mr. GRAHAM: Anyone who has watched the lockage of a boat of about the capacity of the lock can readily understand that it is a long while before you can even think of starting to let the water in. It is a very delicate task.

Hon. Mr. CASGRAIN: Because the water comes in only at one place.

Right Hon. Mr. GRAHAM: You would have to rebuild your whole system.

Col. DUBUC: Exactly.

Hon. Mr. CASGRAIN: It would be easy to fix that up.

Col. DUBUC: It would cost millions and millions, Senator. Even at that, I don't believe you would gain 5 minutes in the operation. What is more serious than the water is the size of the boat in relation to the size of the locks.

Hon. Mr. McLENNAN: But presumably in the ship canal there would be more margin.

Col. DUBUC: In the Welland Ship Canal the length of the lock between gates is 859 feet, leaving 829 feet of useful length. The largest lake boat now is, I believe, under 630 feet over all, which means that she will have a clearance of nearly 200 feet. Besides the inflow of water in the Welland Ship Canal will be by side tunnels.

Right Hon. Mr. GRAHAM: These two locks in the Cornwall canal are like the grade on a railway; they control your traffic.

Col. DUBUC: Suppose you were to build two other locks duplicating them, your next weak point during low water periods would be at Morrisburg, where you would have to build another lock, and even then you would only be near the capacity of either the Lachine or the Soulages Canal.

Right Hon. Mr. GRAHAM: Could you give us an estimate of the traffic, because you have taken the weak spot.

Col. DUBUC: Like a chain, the system is no stronger than its weakest link, and to me there is only one way of knowing what is the traffic and the capacity, and that is by lockages. There is no better way that I can think of. Registered tonnage does not give it exactly, neither does freight.

Hon. Mr. SMITH: How much would it increase the capacity if you duplicated the locks at Cornwall and other places above? Suppose you put in another lock alongside, a twin lock?

Col. DUBUC: By building two locks at Cornwall and one at Morrisburg, at the upper end of Rapide Plat, you might possibly increase the capacity of the canal to 60 lockages per day instead of 40.

Right Hon. Mr. GRAHAM: That would be only for boats of the same draft?

Col. DUBUC: Absolutely. You would increase the traffic of the present 14 foot boats.

Right Hon. Mr. GRAHAM: But you could not handle the larger boats?

Col. DUBUC: No, you could not.

Hon. Mr. REID: If you made the locks the full length, like the one at the head of the Galops Canal—that is three locks—what would that cost, and how much would it increase the capacity.

Col. DUBUC: Well, I would think offhand, because I have not the levels nor foundations, but from my information, a couple of locks at Cornwall would undoubtedly cost at least a million and a half.

Hon. Mr. CASGRAIN: Twin locks?

Col. DUBUC: Yes, making the present locks twins by building a new one adjoining each. The lock at Morrisburg would cost, I would think, probably three-quarters of a million to a million dollars.

Hon. Mr. REID: Supposing you put two locks in the Morrisburg canal—there are two now—the size of those that are to be built with the new waterway—You have one at the head of the Galops canal now?

Col. DUBUC: Yes.

Hon. Mr. REID: That would enable vessels to come down to the Cornwall canal, of the full size of the proposed waterway.

Col. DUBUC: You mean the proposed waterway? You are still remaining at 14 feet draft.

Hon. Mr. REID: No, no. Building the locks long enough, with the 14 feet draft. Now you have two locks at Morrisburg. How many would it take in the Cornwall canal to make them of the same length?

Col. DUBUC: You have six locks in the Cornwall canal now.

Hon. Mr. REID: Do you require six?

Col. DUBUC: If you want a duplicate, yes.

Hon. Mr. REID: So a vessel 675 or 700 or 800 feet long could go on through to Montreal?

Col. DUBUC: I know of no such shallow boats relative to length with a draft of only 14 feet.

Hon. Mr. REID: But leaving the draft at 14 feet. I mean they would have to dredge the 14 feet afterwards to make it 25. They could do that.

Col. DUBUC: Not through the present locks.

Hon. Mr. REID: Supposing you started now to build your locks the full length.

Col. DUBUC: Welland Ship canal size?

Hon. Mr. REID: Yes. The locks of course could be built now, and the dredging go on through the Morrisburg canal and the Cornwall canal—

Right Hon. Mr. GRAHAM: Have you the width there?

Hon. Mr. REID: The widths are all the same as the Welland Canal. What would those locks cost? You say there are six locks in the Cornwall canal.

Col. DUBUC: When I said six, I meant that there were now six locks in the Cornwall canal. If you wanted to double its capacity you would build six other 14 foot locks. But to build a deep waterway you would not build such locks at all, but fewer and much bigger ones with higher heads, as mentioned in the report of the Joint Board of Engineers which recommends only two locks at Cornwall and one at Crysler Island.

Hon. Mr. REID: And two at Morrisburg in the present canal.

Col. DUBUC: No. There would have to be a dam at Crysler Island to start with and another near Barnhart Island. The cost of excavation would be prohibitive if you intended simply deepening and not raising the level of the water by dams. And you would besides practically kill the power scheme.

Hon. Mr. REID: With 14 feet of water there.

Col. DUBUC: Yes, because the locks in the recommended project are built in conjunction with dams elevating the water above Crysler and Barnhart Islands.

Hon. Mr. REID: Your proposition is to make the whole thing 30 feet instead of 25?

Col. DUBUC: Those were your premises. You said Welland ship canal size.

Hon. Mr. REID: I am speaking about the size of the locks, not the depth.

Col. DUBUC: One is correlated to the other.

Right Hon. Mr. GRAHAM: You cannot build a ship to occupy those locks unless you make a greater depth than 14 feet, can you?

Hon. Mr. McLENNAN: You would have to put in your masonry.

Col. DUBUC: In the Welland ship canal all the permanent constructions were built for 30-foot navigation. The reaches were left to between 25 and 27 feet, subject to further dredging as needed.

Right Hon. Mr. GRAHAM: But your locks are 30 feet?

Col. DUBUC: All permanent structures are down to 30 feet.

Hon. Mr. McLENNAN: Am I right in gathering from your figures that if the trade of the St. Lawrence increases in the future as it has in the past, the country must look forward to an improvement in these canals in order that they may take care of that increase until the deep waterway is built through?

Col. DUBUC: Quite so, if they want to keep all the future increase in 14-foot traffic that offers.

Hon. Mr. McLENNAN: If they want a 14-foot channel, so that business in the port of Montreal may not be stifled, that has got to be done.

Col. DUBUC: You must first bring the present 14-foot canal system between Lake Ontario and Lake St. Francis to the capacity of the Soulanges and the Lachine. Then you will have something around 14,000,000 tons of capacity in cargo. Last year you had over 7,000,000 tons, representing a direct increase of 30 per cent over the previous year.

Hon. Mr. McLENNAN: You have to have more canals to keep on with anything like that increase in business?

Col. DUBUC: Exactly. You would later have to rebuild your whole system.

Hon. Mr. McLENNAN: The cost of the deep waterway has to be increased by the cost of these necessary improvements?

Col. DUBUC: If you want to have your canal system able to handle the traffic which is liable to present itself in the next ensuing years.

Hon. Mr. McLENNAN: Your present capacity would be quite exhausted by—what did they tell us?—I think, 1934.

Col. DUBUC: The traffic will depend on many things. It will depend mainly on the crop but not only on that. It will depend also on the marketing of the crop and equally on the available tonnage to carry it. So there are three main factors. If they are all positive, of course, you will have a tremendous traffic, but one may be positive and another negative.

Hon. Mr. CURRY: What increase can we handle with the present system? Can we handle another 30 per cent increase?

Col. DUBUC: I have just stated that locks 15 and 17 are the weakest link in the whole system. In 1927 they were running at about 75 per cent of their capacity. There is room for another 25 per cent, should the traffic present itself in the same way as it has in the past. Of course you cannot regulate it; you cannot force a boat to come in July when it wants or can get its cargo only in September. The present situation means that you have only 25 per cent of play in the Cornwall canal, and the increase last year alone in actual tonnage was 30 per cent and in lockages 22 per cent over the previous year.

Hon. Mr. CURRY: Then if we have another increase of 30 per cent this year the maximum will be reached. We cannot go beyond that.

Col. DUBUC: Practically.

Right Hon. Mr. GRAHAM: As a matter of fact, Colonel Dubuc, in order to provide for your traffic you must have accommodation that is above your maximum, because your traffic may not come regularly.

Col. DUBUC: Of course I am assuming that the traffic will present itself in the same way.

Right Hon. Mr. GRAHAM: It may not.

Hon. Mr. McLENNAN: The same way as it did in the past?

Right Hon. Mr. GRAHAM: As an element of safety you ought to have considerably wider accommodation—the maximum accommodation ought to be greater than will actually provide for the traffic.

Hon. Mr. CASGRAIN: To take care of the ships.

Col. DUBUC: Not only that, but when I say that an increase of 25 per cent will clog the Cornwall canal, I mean that the 25 per cent must apply in the lean months as well as in the others, as otherwise if the increase concentrates only at the end of the season the clogging will happen so much sooner.

Hon. Mr. McLENNAN: You have not figures available on that, as to the peaks in the spring and the autumn?

Col. DUBUC: Well, I gave the monthly average for the whole of 1927. It was 28 in April—I am speaking of lockages now—28 in April, 31 in May, 33 in June, 23 in July.

Hon. Mr. McLENNAN: That is where the drop occurs. When does that pick up?

Col. DUBUC: It was 33 in August. It just so happened. I assume that the market was then calling for grain and the sellers were getting the prices they wanted, so it was shipped.

Right Hon. Mr. GRAHAM: You need not answer these questions unless you like. Would you care to express an opinion as to the effect it will have on Montreal if the St. Lawrence Deep Waterways scheme is carried through?

Col. DUBUC: I would rather not, sir. I cannot forget how well you trained us, when you were our Minister, not to give opinions for the Department, but facts.

Right Hon. Mr. GRAHAM: I can understand that you, being an official of the Department, may not care to express an opinion. This other question may be different, Colonel, but you need not answer it unless you want to. Would you care to express an opinion about the Oswego canal, the canal between Oswego and Albany?

Col. DUBUC: With regard to that, there are very obvious facts which militate against its being successful, I should think; but I would rather you asked Mr. Henry who is here and who has made a special study of that.

Right Hon. Mr. GRAHAM: I am sorry I cannot ask him, because I shall not be here. I have to leave.

Hon. Mr. MURPHY: I think Mr. McLachlan too told us something about that.

Col. DUBUC: That Lower Lake Terminal Board did go very extensively into that.

Hon. Mr. CASGRAIN: There is a two-million elevator at Oswego, and it never had any grain except 900,000 bushels of Canadian grain.

Right Hon. Mr. GRAHAM: One or two of the gentlemen appearing before the Committee have laid great stress on the Oswego Canal. I was never much enamoured of it myself.

Hon. Mr. BEAUBIEN: You told us that the increase last year was 30 per cent.

Col. DUBUC: The increase in cargo at lock 15 over the previous year, the increase in 1927 over 1926, was 30 per cent.

Hon. Mr. BEAUBIEN: Was that not an abnormal increase in one year? What would be the increase within the last five years?

Col. DUBUC: I am speaking of cargo now. In 1923 over 1922 it was 9 per cent; in 1924 over 1923 it was 26 per cent; in 1925 over 1924, it was 12 per cent. In 1926, on account of that special condition of the scarcity of tramp boats to clear Montreal, there was a decrease of 4 per cent; and in 1927 over 1926 an increase of 30 per cent.

Hon. Mr. BEAUBIEN: Except for 1926 there was a pretty steady increase?

Hon. Mr. McLENNAN: Yes. There is a large increase anyway.

Col. DUBUC: As a matter of fact, going back to a previous year, I find that in 1921 there was an increase of 33 per cent over 1920.

Hon. Mr. SMITH: In view of the fact that it would take some years to build the deep waterway it seems to me important that we should know something about what it would cost to increase the present canals to the capacity that is likely to take care of the traffic.

Col. DUBUC: For what period of years?

Hon. Mr. CASGRAIN: For the next ten years.

Hon. Mr. SMITH: Say the next ten years, or whatever time it is going to take to build the deep waterway.

Hon. Mr. MURPHY: Between now and the time the deep waterway would be available.

Hon. Mr. CASGRAIN: Yes, about fifteen years, to judge by the Welland canal.

Col. DUBUC: To take care of all the traffic which it is reasonable to assume will present itself in the next ten years, even anticipating a yearly increase of only 10 per cent, would need the rebuilding of all the present canals between Lake Ontario and Montreal, the cost of which would be totally unthinkable in view of the fact that it would be only a temporary relief pending the building of the deep waterway.

Hon. Mr. SMITH: Supposing you brought the upper ones to the capacity of the Soulanges canal and the Lachine?

Col. DUBUC: Meaning to increase the capacity of our canals from Lake Ontario to Lake St. Francis from 9,000,000 tons to 14,000,000 tons? It is hard to answer that offhand, but assuming that two extra locks at Cornwall and one at Morrisburg would be sufficient, I believe that it might be done at a cost of between two and three million dollars.

Hon. Mr. CASGRAIN: That 30 per cent increase was an increase in 1927 over 1926, which was an abnormally low year.

Hon. Mr. McLENNAN: Yes, but there is a general increase of about 20 per cent, roughly speaking, which has gone on.

Hon. Mr. SMITH: Evidently you would have to do something. What would you suggest? You must do something to take care of the ten years during which you are perhaps going to build the other canals.

Col. DUBUC: One thing might be done undoubtedly: that would be to establish a lower lake terminal port, say, at Prescott, or at Gananoque or at Kingston, and have the freight transferred from there by rail to Montreal until such time as you build your deep waterway.

Hon. Mr. CASGRAIN: What would you figure it would cost to transport a bushel by rail to Montreal?

Col. DUBUC: Mr. Henry is better qualified to answer that.

Hon. Mr. REID: Colonel, what I wanted to find out was this. I think the deep waterway scheme suggested two new locks in Cornwall, and these would pass the ships through the Cornwall canal. It may be more, but that does not matter. What would it cost—you may not have the figures now, but perhaps you could give them—what would it cost if we decided, say, on building the deep waterway locks in the Cornwall canal, on our side of the river? First, how much would that increase the capacity of the canal system? That is the weak point. And how long would it take to build those locks? Of course if the locks were built of a much greater length they would increase the capacity until the dredging was all done, because they would accommodate boats that would be much longer, while still on a 14-foot draft, as I understand it.

Col. DUBUC: There is not a tremendous amount of dredging, comparatively, in the project of the deep waterway.

Hon. Mr. REID: There is a lot of dredging to be done at the Galops. They are going to dredge away a new channel through there.

Col. DUBUC: Of course I am not speaking of the power end.

Hon. Mr. REID: I am speaking of the new canal that would strengthen the link where there is such a shortage at the present time. I would like to know how much that would increase the capacity of the canal system, pending the final completion of the scheme. I am assuming that we would go on with the rest of it as well, but the building of the two locks would help us out con-

siderably in the meantime and should not take more than probably a couple of years.

Col. DUBUC: The Joint Board of Engineers have considered both the navigation and the power end of it, providing for 25 or 27 feet of navigation between Lake Ontario and Montreal.

Hon. Mr. REID: That scheme is all right. There is only one difference there, that they provided for building new locks and a canal on the American side. Now, you see, I mean the building of these two new locks—even if they want to build the other as well—in the Cornwall canal.

Col. DUBUC: On the Canadian side?

Hon. Mr. REID: On the Canadian side.

Col. DUBUC: I think Mr. McLachlan told you that they had estimated the extra cost of building the locks there at over \$3,000,000.

Hon. Mr. MURPHY: Three and a half millions.

Hon. Mr. REID: Then, if we spent three and a half millions more on the canal that would help us tremendously with the capacity of the canal system, pending the proceeding with the Crysler Island Dam and the dredging at Galops, which would take ten or fifteen years.

Col. DUBUC: Well, you must not forget, though, that the scheme of the two locks and the estimate given to you by Mr. McLachlan presupposed a dam at Crysler Island and another at Barnhart Island.

Hon. Mr. REID: I am not saying to eliminate Crysler at all, but you say that the weak point is right in the Cornwall canal.

Col. DUBUC: Yes.

Hon. Mr. REID: Now, if we fix up the Cornwall canal, which would not take so many years, because there are only—

Hon. Mr. McDUGALD: I do not think that is very clear, Doctor Reid. Do you mean to leave the Cornwall canal at the present 14 foot depth and lengthen your locks there, or do you mean to deepen it to 25 feet?

Hon. Mr. REID: Deepen it to 25 feet.

Hon. Mr. McDUGALD: I do not think Colonel Dubuc understood it that way. Could that be done?

Col. DUBUC: You would have to build the locks to 30 feet in order to have them fit in with the Welland Ship Canal and by dams raise the reaches above and below Crysler island to a much higher level.

Hon. Mr. McDUGALD: But that could not be done for three and a half million dollars, colonel?

Col. DUBUC: Nowhere near it.

Hon. Mr. McDUGALD: That is the point Doctor Reid is making.

Col. DUBUC: The three and a half millions only refer to the extra cost of changing the location of the locks in the International section as proposed by the Joint Engineering Board from the American to the Canadian side of the river:

Hon. Mr. REID: That is, for the Cornwall canal.

Hon. Mr. McDUGALD: Yes, for a 25-foot canal.

Col. DUBUC: But it would not help us very much, Senator Reid, if you improved only the Cornwall canal. You would simply be creating another weak link at the Morrisburg canal, and when you have done that, you have only brought the system to the capacity of the Soulanges and the Lachine, and no more.

Hon. Mr. REID: Those two locks in the Cornwall canal are the weak point.

Col. DUBUC: The weakest.

Hon. Mr. REID: Of course if they were improved that would increase the capacity, even at the present depth of 14 feet, because of the larger locks.

Col. DUBUC: Up to the level of the next weakest link, which is at Morrisburg; and then if you improve Morrisburg you bring the system up to the level of the next weakest link.

Hon. Mr. REID: I am not talking of that.

Hon. Mr. McDUGALD: Let us clear that up, Doctor Reid.

Hon. Mr. REID: In the first place I am taking it for granted that the Crysler Island dam will be built and that would provide for everything west of that. Now, as to the Cornwall canal, my idea is this, that if you build the locks on the Canadian side, that clears up Cornwall canal. There is a 25-foot depth for the full length of the Welland canal.

Col. DUBUC: The locks are 30 feet deep.

Hon. Mr. REID: Yes. Now, to build the locks alone, it seems to me, does not take as long as the dredging. If you built the locks, fixed the Cornwall canal, so that you could go on and have this waterway on the Canadian side, that would very materially increase the capacity, pending the proceeding with the rest.

Col. DUBUC: Undoubtedly, if you do not forget the dams.

Hon. Mr. REID: Or you could go on with the rest at the same time if you liked.

Col. DUBUC: It would undoubtedly.

Hon. Mr. REID: That is the point I wanted to get at.

Col. DUBUC: Then, you see, you would build the Crysler Island dam anyway, and the lock there. If you raise the water at that dam you will eliminate the need of using the Galops canal with 14 feet of navigation.

Hon. Mr. REID: Or Morrisburg?

Col. DUBUC: Exactly.

Hon. Mr. REID: You do not have to do anything more except the Cornwall canal?

Col. DUBUC: And the dam at Barnhart island.

Hon. Mr. REID: That is what I mean.

Col. DUBUC: But then you will be limited to the capacity of the canals below, which are the Soulanges and the Lachine.

Hon. Mr. REID: That is all right, but I am taking it for granted that the whole scheme is going right through.

Col. DUBUC: Which would only increase your capacity to that of the Soulanges, which is about 50 per cent over present system capacity.

Hon. Mr. REID: I am taking it for granted that they will go on with the Crysler Island dam. Go on now if you like. That brings us down to the Cornwall canal.

Col. DUBUC: Right.

Hon. Mr. REID: Now, what I am asking is this. If you build the locks for the new waterway in the Cornwall canal—of course you have the dredging to do as well, but if you had the locks the full Welland canal size, vessels could probably carry twice as much cargo right through there, or anyway a very much larger quantity, because the vessels will be twice the size, though drawing only 14 feet from Prescott until they get the canal dredged out.

Col. DUBUC: I do not believe that you can have such a boat, of such a length, but so shallow. Those boats, in order to have the necessary rigidity, must have sufficient depth, and I cannot imagine a boat that would be, say, 650 feet long and use, loaded, only 14-foot draft.

Hon. Mr. REID: They are not going to be on the lakes; they are from Prescott down. I am not speaking of the lakes. This is only pending the completion of the whole works, which will probably take ten years.

Col. DUBUC: They could not go further down than the foot of Lake St. Francis and once you have done that, you have brought the whole system only up to the capacity of the Soulanges and the Lachine.

Hon. Mr. REID: All right, I am talking about bringing it up to the capacity of the complete waterway.

Col. DUBUC: Yes, but you have brought it down by building that lock at Crysler and those locks at Cornwall—you have brought it down to Lake St. Francis.

Hon. Mr. REID: Down to Valleyfield.

Col. DUBUC: Yes, down to Lake St. Francis. Then you must bring that boat down the Soulanges and the Lachine.

Hon. Mr. REID: Of course the Soulanges is going on now. I expect that.

Col. DUBUC: Up to a capacity of about 50 per cent more than the present Cornwall. So you may increase the Cornwall 500 per cent, but the capacity of your system is only increased 50 per cent.

Hon. Mr. REID: I was taking it for granted that this Beauharnois scheme that is going on is going to be the new waterway.

Col. DUBUC: I do not know about that.

Hon. Mr. REID: Of course I was taking it for granted that that would get us right through to Lachine.

Col. DUBUC: Even then you are clogged again at the Lachine canal.

Hon. Mr. REID: But of course they have to go on with it too.

Hon. Mr. CASGRAIN: You could have two locks parallel and you would have twice the efficiency at the particular spot.

Hon. Mr. MURPHY: This discussion mixes up two or three different things. The witness has very properly explained that between now and the time the deep waterway was completed, if that work were gone on with, it would be unthinkable to build another set of canals and locks.

Col. DUBUC: Just for ten years.

Hon. Mr. MURPHY: Just for ten years.

Col. DUBUC: And the completion of them would take four or five years anyway.

Hon. Mr. MURPHY: Much of the discussion has been of a confused character, due to the questions asked the witness being directed to a different quarter from the one which the witness is occupying and from which he is speaking. The increase about which he has told the Committee was altogether restricted to the present system.

Col. DUBUC: Exactly.

Hon. Mr. MURPHY: That is based on its thus far unused capacity.

Col. DUBUC: Yes. It does not contemplate any new work.

Hon. Mr. REID: Of course Colonel Dubuc is really in charge of the Department, so that he is equally able to speak on any point, whether it is the present canal system or the new works.

Hon. Mr. MURPHY: Yes.

Col. DUBUC: In corroboration of the figures mentioned in the evidence just given, I beg to hand in six tabulations:—

1. Table 39, Dominion Bureau of Statistics, Traffic on Canadian Canals;
2. Table 40, Dominion Bureau of Statistics, Traffic through Sault Ste. Marie Canals;
3. Traffic and freight tons through Sault Ste. Marie canals, showing yearly from 1911 to 1927 inclusive, freight of Canadian and American origin through Canadian and American locks;
4. Traffic, Lock 15—Cornwall canal, including number of lockages, vessel registered tonnage and freight carried yearly from 1913 to 1927, inclusive;
5. Cornwall canal—Summary of lockages through lock 15 during 1925, 1926 and 1927, giving total of monthly eastbound and westbound lockages and daily averages;
6. A statement of daily lockages through lock 15, Cornwall canal, during the season of 1927, showing separately downbound and upbound traffic.

The CHAIRMAN: Thank you very much, Colonel.

Canal Statistics, 1927, published by the Dominion Bureau of Statistics, Transportation Branch, Department of Trade and Commerce

TABLE 39—TRAFFIC ON CANADIAN CANALS

Year	Canadian Vessels		United States Vessels		Freight Carried				
					Originating in Canada		Originating in United States		**Total
	Number	Registered Tonnage	Number	Registered Tonnage	Tons	Per cent of Total	Tons	Per cent of Total	Tons
1900.....	21,755	4,129,250	5,502	2,408,985	-	-	-	-	5,013,693
1901.....	20,860	3,980,264	5,634	2,482,274	-	-	-	-	5,665,259
1902.....	22,198	4,465,695	6,433	4,086,439	-	-	-	-	7,513,197
1903.....	23,767	5,212,832	6,695	4,236,475	-	-	-	-	9,203,817
1904.....	21,851	4,772,100	6,253	3,655,905	-	-	-	-	8,256,236
1905.....	23,726	5,191,191	7,085	5,096,241	-	-	-	-	9,371,744
1906.....	25,498	5,526,321	7,319	5,685,315	-	-	-	-	10,523,185
1907.....	28,833	6,328,911	9,328	11,604,834	-	-	-	-	20,543,639
1908.....	29,040	6,780,789	7,489	8,521,139	5,012,147	28.7	12,190,673	71.3	17,502,820
1909.....	22,507	7,811,573	9,996	16,459,322	7,001,621	20.8	26,719,127	79.2	33,720,748
1910.....	25,337	8,931,790	11,462	21,777,297	7,439,368	17.3	35,551,240	82.7	42,990,608
1911.....	25,585	9,172,192	10,370	18,231,622	7,792,907	20.5	30,237,446	79.5	38,030,353
1912.....	27,371	10,237,335	11,785	24,636,190	9,376,529	19.7	38,210,716	80.3	47,587,245
1913.....	28,654	12,078,041	10,739	24,238,788	11,130,875	21.3	40,923,038	78.7	52,053,913
1914.....	26,125	12,050,856	7,742	15,636,414	9,382,206	25.3	27,641,031	74.7	37,023,237
1915.....	21,575	9,398,207	6,415	7,385,101	6,789,423	44.7	8,409,380	55.3	15,198,803
1916.....	23,002	9,839,029	6,800	10,660,839	7,486,962	31.7	16,096,529	68.3	23,583,491
1917.....	21,588	9,831,694	6,594	10,259,772	5,964,369	26.8	16,274,566	73.2	22,238,936
1918.....	19,809	7,800,972	6,791	9,616,200	3,369,477	17.8	15,514,142	82.2	18,883,619
1919.....	20,682	8,725,973	4,092	5,259,173	4,865,831	48.7	5,129,435	51.3	19,995,266
1920.....	23,038	8,521,643	3,826	3,338,890	4,094,044	46.9	4,641,339	53.1	8,735,383
1921.....	25,720	10,079,388	2,969	2,330,178	4,562,028	48.5	4,844,993	51.5	9,407,021
1922.....	26,217	11,059,261	3,735	3,165,054	6,273,227	62.1	3,752,828	37.9	10,026,055
1923.....	27,112	13,013,970	3,399	3,325,809	7,637,485	68.2	3,561,949	31.8	11,199,434
1924.....	27,467	13,988,909	3,233	2,821,177	8,857,177	68.8	4,011,920	31.2	12,869,097
1925.....	28,361	14,964,785	3,587	3,824,924	9,750,311	67.7	4,560,356	32.2	14,130,667
1926.....	27,965	14,542,485	3,543	3,144,866	9,656,190	71.7	3,821,473	28.3	13,477,663
1927.....	36,162	17,472,601	4,013	3,364,461	11,863,931	67.84	5,624,380	32.16	17,488,311

St. Andrew's Canal opened for traffic in 1910. Origin of cargo not shown prior to 1908.

* † See note Table 40.

** Includes duplications where cargoes use two or more canals.

Canal Statistics, 1927, published by the Dominion Bureau of Statistics,

TABLE 40—TRAFFIC THROUGH

Canadian Lock									
Year	Canadian Vessels		United States Vessels		Total Number	Vessel Tonnage	Freight Tons		
	Number	Tonnage	Number	Tonnage			Canadian	Percent- age	United States
1900.....	1,790	577,310	1,291	1,617,438	3,081	2,194,748	-	-	-
1901.....	2,796	775,151	1,408	1,674,597	4,204	2,449,748	-	-	-
1902.....	3,080	1,366,930	1,964	3,237,372	5,044	4,604,302	-	-	-
1903.....	2,710	1,615,939	1,640	3,146,807	4,351	4,762,746	-	-	-
1904.....	2,637	1,555,042	1,325	2,675,663	3,962	4,230,705	-	-	-
1905.....	3,970	1,803,288	1,692	2,734,349	5,662	5,537,637	-	-	-
1906.....	3,922	1,959,252	1,758	4,399,872	5,680	6,359,124	-	-	-
1907.....	3,217	2,154,688	3,132	9,961,281	6,349	12,115,969	-	-	-
1908.....	3,289	2,603,232	2,004	7,035,655	5,293	9,638,887	2,092,231	16.39	10,666,985
1909.....	2,597	2,988,936	3,734	14,850,738	6,331	17,839,674	2,990,059	10.73	24,871,186
1910.....	2,744	3,173,494	5,228	20,187,704	7,972	23,361,198	2,943,022	8.06	33,551,665
1911.....	2,713	3,108,880	4,068	16,252,340	6,781	19,361,220	3,177,581	10.27	27,774,128
1912.....	2,643	3,296,229	5,213	22,536,015	7,856	25,832,244	4,090,362	10.31	35,579,293
1913.....	3,279	3,793,434	5,006	22,181,007	8,285	25,974,441	4,954,734	11.60	37,744,590
1914.....	3,011	3,473,292	2,966	13,827,870	5,977	*17,301,162	3,609,747	13.08	23,989,437
1915.....	3,000	3,041,003	1,331	5,443,812	4,331	8,484,815	2,561,734	33.05	5,189,223
1916.....	4,595	4,089,937	2,094	8,703,187	6,689	12,793,124	4,155,911	24.72	12,657,738
1917.....	3,199	3,182,960	2,138	8,712,604	5,337	11,895,564	2,875,590	18.62	12,571,502
1918.....	3,067	2,436,500	1,992	7,594,042	5,059	10,030,542	1,336,861	10.35	11,576,850
1919.....	3,140	2,817,096	929	3,671,634	4,069	16,488,730	1,606,311	38.82	2,531,774
1920.....	3,239	2,415,775	771	2,725,431	4,010	5,141,206	1,286,251	51.91	1,191,567
1921.....	3,464	2,676,320	399	1,115,072	3,863	3,791,392	1,483,444	74.26	514,148
1922.....	3,021	3,010,713	481	1,733,761	3,502	4,474,474	1,258,860	73.66	450,200
1923.....	3,812	3,915,740	654	2,433,964	3,866	6,349,704	1,775,872	78.72	480,057
1924.....	2,840	3,406,744	476	1,585,827	3,316	4,992,571	1,415,443	86.75	216,105
1925.....	2,889	3,408,387	645	2,279,160	3,534	5,687,547	1,427,968	87.34	207,002
1926.....	2,693	3,357,785	657	1,594,186	3,350	4,951,971	1,207,216	84.82	216,059
1927.....	2,818	3,269,941	421	1,214,782	3,239	4,484,724	1,306,507	88.92	164,044

*Third lock of United States Sault Ste. Marie canal opened Oct. 21, 1914.

†Fourth lock of United States Sault Ste. Marie canal opened Sept. 18, 1919.

DEVELOPMENT OF ST. LAWRENCE RIVER

211

Transportation Branch, Department of Trade and Commerce.

SAULT STE-MARIE CANALS

				Canadian and United States Locks					
		Lockages	Days open	Vessels		Freight	Canadian Freight through canals	Percentage through Canadian Canal	Year
Percent-age	Total	Number	Number	Number	Tonnage	Tons	Tons		
-	2,035,677	2,205	238	19,452	22,315,834	25,643,073	-	-	8..1900
-	2,820,394	2,910	246	20,041	24,626,976	28,403,065	-	-	10..1901
-	4,729,268	3,418	264	22,659	31,955,582	35,961,146	-	-	13..1902
-	5,511,868	3,242	256	18,596	27,736,444	34,674,437	-	-	16..1903
-	5,030,705	3,022	241	16,120	24,364,138	31,546,106	-	-	16..1904
-	5,473,406	4,031	255	21,679	36,617,699	44,270,680	-	-	12..1905
-	6,574,039	4,152	253	22,155	41,098,324	51,751,080	-	-	13..1906
-	15,588,165	4,596	238	20,437	44,087,974	58,217,214	-	-	27..1907
83-61	12,759,216	3,667	235	15,181	31,091,730	41,890,557	2,774,029	31..1908	
89-27	27,861,245	5,046	240	19,204	46,751,717	57,895,149	3,283,319	48..1909	
91-94	36,395,687	6,110	248	20,899	49,856,123	62,363,213	3,320,865	58..1910	
89-73	30,951,709	6,802	236	18,673	41,653,488	53,477,216	3,732,982	58..1911	
89-69	39,669,655	6,200	240	22,778	56,736,807	72,472,676	5,322,713	55..1912	
88-40	42,699,324	6,266	246	23,795	57,989,710	79,718,344	7,239,993	54..1913	
86-92	27,599,184	4,712	239	18,717	41,986,339	55,369,934	4,810,494	50..1914	
66-95	7,750,957	4,374	248	21,233	56,399,147	71,290,304	6,830,819	11..1915	
75-28	16,813,649	4,777	245	25,407	69,824,463	91,888,219	8,256,881	18..1916	
81-38	15,447,092	4,142	237	22,885	65,307,233	89,813,898	6,950,219	17..1917	
89-65	12,913,711	4,034	241	20,610	61,100,244	85,680,327	3,116,727	15..1918	
61-18	4,138,085	3,174	247	17,587	50,092,721	68,235,668	4,326,168	6..1919	
48-09	2,477,818	3,076	244	18,848	58,196,498	79,279,630	4,599,064	3..1920	
25-74	1,997,592	3,066	251	12,824	32,187,795	48,254,116	6,753,413	4..1921	
26-34	1,709,060	2,881	252	17,378	52,598,749	66,064,883	8,960,748	3..1922	
21-28	2,255,929	3,283	240	21,974	68,547,016	91,376,831	9,526,721	2..1923	
13-25	1,631,548	2,791	241	17,867	57,291,961	72,034,854	8,741,539	2..1924	
12-66	1,634,970	3,031	254	20,651	69,237,687	81,871,699	9,816,158	2..1925	
15-18	1,423,275	2,765	231	20,898	71,280,829	85,681,615	9,545,455	2..1926	
11-08	1,470,551	2,755	251	18,759	64,327,825	83,353,040	9,432,758	2..1927	

TRAFFIC IN FREIGHT TONS THROUGH SAULT STE. MARIE CANALS

Year	Canadian lock			Canadian and American locks			Canadian origin through American locks only
	Canadian origin	American origin	Total	Canadian origin	American origin	Total	
1911.....	3,177,581	27,774,128	30,951,709	3,732,982	49,744,234	53,477,216	555,401
1912.....	4,090,362	35,579,293	39,669,655	5,322,713	67,149,963	72,472,676	1,232,351
1913.....	4,954,734	37,744,590	42,699,324	7,239,993	72,478,351	79,718,344	2,285,259
1914.....	3,609,747	23,989,437	27,599,184	4,810,494	50,559,440	55,369,934	1,200,747
1915.....	2,561,734	5,189,223	7,750,957	6,830,819	64,459,485	71,290,304	4,269,085
1916.....	4,155,911	12,657,738	16,813,649	8,256,881	83,631,338	91,888,219	4,100,970
1917.....	2,875,590	12,571,502	15,447,092	6,950,219	82,863,679	89,813,898	4,074,629
1918.....	1,336,861	11,576,850	12,913,711	3,116,727	82,563,600	85,680,327	1,779,866
1919.....	1,606,311	2,531,774	4,138,085	4,326,168	63,909,500	68,235,668	2,719,857
1920.....	1,286,251	1,191,567	2,477,818	4,599,964	74,679,666	79,279,630	3,313,713
1921.....	1,483,444	514,148	1,997,592	6,753,413	41,500,703	48,254,116	5,269,969
1922.....	1,258,860	450,200	1,709,060	8,960,748	57,104,135	66,064,883	7,701,888
1923.....	1,775,872	480,057	2,255,929	9,526,721	81,850,110	91,376,831	7,750,849
1924.....	1,415,443	216,105	1,631,548	8,741,539	63,293,315	72,034,854	7,326,096
1925.....	1,427,968	207,002	1,634,970	9,816,158	72,055,541	81,871,699	8,388,190
1926.....	1,207,216	216,059	1,423,275	9,545,455	76,136,160	85,681,615	8,338,239
1927.....	1,306,507	164,044	1,470,551	9,432,758	73,920,282	83,353,040	8,126,251

NOTE—Davis Lock on American Side opened October 21, 1914.
Fourth Lock on American Side opened September 18, 1919.

TRAFFIC LOCK 15—CORNWALL CANAL

Year	Number of Lockages				Vessel Registered Tonnage				Freight carried in Tons			
	East	West	Total	Increase over previous year	East	West	Total	Increase over previous year	East	West	Total	Increase over previous year
				p. c.				p. c.				p. c.
1913....	2,307	2,374	4,681	-	1,704,956	1,785,937	3,490,893	-	2,814,826	656,102	3,470,928	-
1914....	2,252	2,329	4,581	-2	1,861,310	1,938,570	3,799,880	9	3,088,904	590,991	3,679,895	6
1915....	1,951	2,040	3,991	-11	1,502,048	1,540,445	3,042,493	-20	2,259,773	544,701	2,804,474	-24
1916....	2,249	2,284	4,533	14	1,606,760	1,585,954	3,192,714	5	2,281,080	549,144	2,830,224	1
1917....	2,392	2,382	4,774	5	1,733,426	1,695,197	3,428,623	7	2,592,326	388,971	2,981,297	5
1918....	2,270	2,180	4,450	-7	1,660,274	1,462,142	3,122,416	-9	2,368,062	330,634	2,698,696	-9
1919....	2,130	1,950	4,080	-8	1,656,272	1,361,814	3,018,086	-3	2,104,573	375,689	2,480,262	-8
1920....	2,078	2,089	4,167	2	1,471,339	1,408,329	2,879,668	-5	2,183,022	440,285	2,623,307	6
1921....	2,235	2,380	4,615	11	1,794,875	1,846,151	3,641,026	27	3,011,333	475,942	3,487,275	33
1922....	2,268	2,445	4,713	2	1,815,504	1,921,082	3,736,586	3	3,038,220	602,889	3,641,109	4
1923....	2,485	2,295	4,780	1	1,938,023	2,086,511	4,024,534	8	3,394,734	567,698	3,962,432	9
1924....	2,653	2,838	5,491	15	2,342,669	2,449,249	4,791,918	19	4,304,138	693,752	4,997,890	26
1925....	2,736	2,859	5,595	2	2,578,398	2,686,617	5,265,015	10	4,617,563	995,624	5,613,187	12
1926....	2,658	2,869	5,527	-1	2,426,614	2,622,849	5,048,463	-4	4,265,770	1,133,682	5,399,452	-4
1927....	3,301	3,464	6,765	22	3,183,632	3,385,301	6,568,933	30	5,612,207	1,411,601	7,023,808	30

NOTE.—As compared with 1913, statistics for 1927 show an increase of 45 per cent in lockages, 83 per cent in registered tonnage and 102 per cent in cargo carried.

CORNWALL CANAL—SUMMARY OF LOCKAGES THROUGH LOCK NO. 15 DURING 1925,
1926 AND 1927

1925	Eastbound	Westbound	Totals	Daily average
April.....	73	49	122	12
May.....	348	383	731	24
June.....	329	351	680	23
July.....	394	453	847	27
August.....	430	462	892	29
September.....	362	357	719	24
October.....	416	415	831	27
November.....	338	324	662	22
December.....	46	65	111	9
For year.....	2,736	2,859	5,595	24
1926				
April.....	4	3	7	1
May.....	325	352	677	22
June.....	472	487	959	32
July.....	414	463	877	28
August.....	334	367	701	23
September.....	350	404	754	25
October.....	404	400	804	26
November.....	319	351	670	22
December.....	36	42	78	8
For year.....	2,658	2,869	5,527	24
1927				
April.....	122	99	221	28
May.....	467	486	953	31
June.....	483	507	990	33
July.....	350	375	725	23
August.....	487	524	1,011	33
September.....	469	517	986	33
October.....	489	502	991	32
November.....	406	409	815	27
December.....	28	45	73	5
For year.....	3,301	3,464	6,765	29

STATEMENT OF DAILY LOCKAGES THROUGH LOCK 15, CORNWALL CANAL, DURING THE SEASON OF 1927

Day	April		May		June		July		August		September		October		November		December		Day
	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	Down	Up	
1	-	-	10	13	19	12	13	17	11	11	15	19	16	22	17	13	10	8	18
2	-	-	21	17	12	16	12	20	12	12	16	17	15	12	12	11	10	4	5
3	-	-	24	11	10	18	9	9	16	18	33	13	39	15	12	1	4	9	14
4	-	-	16	11	17	10	12	21	15	15	26	29	41	19	16	5	-	-	4
5	-	-	18	13	21	18	7	25	17	15	32	12	19	17	16	15	-	-	12
6	-	-	20	17	28	24	13	14	15	17	32	14	19	18	18	20	5	7	5
7	-	-	16	13	29	28	14	27	13	9	22	13	26	11	16	14	2	3	8
8	-	-	15	16	31	19	14	26	8	16	24	10	18	14	13	14	2	1	9
9	-	-	13	17	23	40	9	15	24	12	24	12	26	12	14	19	3	6	10
10	-	-	14	21	22	36	9	15	10	14	16	18	20	18	15	14	3	-	11
11	-	-	10	13	14	16	30	6	19	18	17	35	17	17	15	13	-	-	12
12	-	-	16	19	20	15	13	10	17	19	26	16	20	21	12	16	-	-	13
13	-	-	12	13	22	10	11	22	22	18	38	12	11	19	12	18	-	-	14
14	-	-	9	20	24	20	40	11	17	22	39	15	41	19	24	24	1	1	15
15	-	-	15	21	15	18	12	23	18	20	25	16	22	16	16	18	-	-	16
16	-	-	11	15	16	16	34	11	14	23	18	17	34	14	18	14	-	-	17
17	-	-	13	14	27	22	40	11	25	18	38	16	35	20	12	6	-	-	18
18	-	-	14	17	31	13	22	12	24	19	19	19	30	11	10	11	-	-	19
19	-	-	15	17	32	15	14	29	16	24	40	17	38	20	19	8	-	-	20
20	-	-	16	24	20	16	36	9	15	24	38	15	38	20	15	19	-	-	21
21	-	-	18	19	18	32	10	11	21	14	32	13	30	15	20	24	-	-	22
22	-	-	18	14	18	32	8	15	23	16	17	18	27	15	15	18	-	-	23
23	14	2	20	21	15	13	28	7	11	17	16	13	29	11	10	19	-	-	24
24	23	1	21	22	13	15	31	6	17	18	23	12	37	19	18	30	-	-	25
25	27	8	17	22	15	13	28	10	14	18	19	10	40	11	13	21	-	-	26
26	12	9	21	39	13	15	31	12	12	20	10	10	30	16	22	23	-	-	27
27	18	20	14	20	18	13	21	15	18	19	16	18	35	18	10	9	-	-	28
28	6	24	38	11	12	23	13	10	18	21	30	11	30	18	9	16	-	-	29
29	12	22	34	15	14	20	11	16	27	17	16	14	30	11	10	25	-	-	30
30	10	18	28	16	14	26	11	15	26	18	15	9	24	17	34	5	-	-	31
31	-	-	-	-	-	-	12	11	20	15	-	-	16	18	-	-	-	-	73
Total	122	99	221	467	483	507	990	375	524	1,011	469	517	986	489	406	409	28	45	

The CHAIRMAN: We have Mr. Henry here; he is Director of the Bureau of Economics of the Canadian National Railways.

Hon. Mr. McDUGALD: Before we start Mr. Henry's evidence I would just like to say a word. During the investigations made by the National Advisory Board I was able, by the courtesy of Sir Henry Thornton, to go to Mr. Henry at all times, and he was in a position to give some very valuable information and supply very valuable data in regard to transportation, not only in connection with railways but in connection with the waterways; and I can say here that the information I obtained from him was of great assistance to myself and other members of the National Committee in arriving at some of the conclusions which we reached. Having that in mind, I think that perhaps you might allow me, as on the occasion when we had the men from the harbour of Montreal here, to prepare some questions. Yesterday I prepared some questions, and submitted them to Mr. Henry last night, having in mind what you said yourself, Mr. Chairman, so that he might be familiar with them, and so that we might cover the ground quickly.

Mr. R. A. C. HENRY, B.A., B.Sc., Director of the Bureau of Economics, Canadian National Railways, was called as a witness.

Hon. Mr. McDUGALD: Will you first state your experience and qualifications, Mr. Henry?

Mr. HENRY: I am a graduate of McGill University in Arts and Science. My experience has been as follows:—

1904-1908—with Canadian Pacific Railway, Construction and Irrigation Department, in capacities of Chainman, Rodman, Levelman and Assistant Engineer.

1909—Assistant Engineer, water power investigation, Department of the Interior.

1911—Superintendent Concrete Construction, Montreal.

1912-1914—Inspecting Engineer on railway construction, Department of Railways and Canals.

1914-1918—Assistant Engineer, Department of Railways and Canals.

1918-1920—General Assistant Engineer, Department of Railways and Canals.

1920-1921—Engineer-in-Charge Grand Trunk Arbitration, for the Department of Railways and Canals.

1922—Special Engineer, Department of Railways and Canals.

1923 to date—Director, Bureau of Economics, Canadian National Railways.

Hon. Mr. McDUGALD: Were you a member of the Grain Elevator Committee which made a report in 1923?

Mr. HENRY: I was.

Hon. Mr. McDUGALD: Will you explain the purpose of that Committee's investigation, please?

Mr. HENRY: The purposes of that Committee's investigation were three-fold; first, to investigate the situation respecting the ownership of elevators at the Bay ports, owned or controlled by the various departments of the Federal Government, including the National Railways, which at that time had been taken over by the Government, in relation to elevators held by private individuals at the same points; second, to see if the facilities, especially of those under the control of the Government, directly or indirectly, could be co-ordinated. And third, to investigate generally the grain movement east from the head of the lakes, in relation to transportation facilities.

Hon. Mr. McDUGALD: Is there anything in that report to which you would like to draw special attention? The report is on file with this Committee.

Mr. HENRY: Well, I think the conclusions in the report have perhaps already been filed. I might explain that that report was based upon a day-

to-day investigation covering the movement of grain in the years 1921 and 1922 from the head of the lakes to Montreal, both by water and by rail. An analysis was made of the daily loadings at Fort William, the daily arrivals and daily unloadings at each of the individual Georgian Bay and Lake Erie ports, the daily loadings from those various points east to Montreal, the daily arrivals at Montreal, and the daily movement of the grain from the cars or boats into the elevators at Montreal. That enabled a precise analysis to be made. In that connection I might draw the attention of the Committee to Graph No. 9 in that report, which for the season of navigation, 1922, shows, in weekly periods, the grain which was in store at Fort William, the length of time it took to carry the grain from the elevators at Fort William to Port Colborne, the time the grain had to stay in the boats at Port Colborne prior to being taken into elevators, the length of time the grain stayed in the elevators, the length of time which it took the boats from loading at Port Colborne to reach Montreal, and the length of time which the grain stayed in the boats before being taken into the elevators at Montreal, and also the length of time which the grain was held in the elevators at Montreal; all those points being necessary to determine the amount of delay which occurred at each of those points; from which was deduced the additional elevator capacity which was required not only to take care of the undue delay at those points in unloading, but also to provide for a reasonable margin of safety. In addition to that, I might point out a further analysis which is included in that report, and which is perhaps of some considerable interest at the present time. That relates to the actual time which it took grain during that period to get from Port Colborne to Montreal. This is Graph No. 14; that is for the season of 1921. There are a series of curves here which indicate a complete cycle, that is to say the average time of all boats which started from Port Colborne with grain for Montreal and returned to Port Colborne. This is based upon an absolute analysis of each individual boat which moved between those points during that time.

Hon. Mr. McDougald: All the boats?

Mr. Henry: All the boats. I cannot tell you now just how many boats there were, but whatever boats there were starting from Port Colborne and going to Montreal and back, we have the complete record.

Hon. Mr. Casgrain: How many days does that cover?

Mr. Henry: The average time from Port Colborne to Montreal is approximately 150 hours—in terms of hours—and that runs from a minimum of 135 to a maximum of 184 hours.

Hon. Mr. Smith: That is the return?

Mr. Henry: The return, yes. This, by the way, eliminates any delays due to detention in Montreal. I am taking that out. I can give you the other figures also. But it is interesting to note the effect of wind and other conditions on the movement. Take the period from the 16th to the 21st of May. There apparently was considerable delay. About the 18th the average time was 184 hours.

Hon. Mr. Reid: Delays in elevation at Montreal?

Mr. Henry: No, delays in the canals due to adverse weather conditions, apparently.

Now, this curve also shows the period of delay in unloading at Montreal, and it runs anywhere from 5 hours up to say 80 hours. The average would appear to be between 30 and 35 hours.

Hon. Mr. McDougald: Does that mean delay beyond the time it ought to take?

Mr. HENRY: No, this means the total number of hours. Now, the complete cycle, when you add those two together, would run apparently between 220 and 230 hours.

Hon. Mr. McLENNAN: Pretty nearly ten days.

Mr. HENRY: There are a number of references in that report which might be of interest to the Committee. I refer particularly to the reference in the beginning to the world's grain trade. It has not changed very greatly since this report was written. That is on pages 4 to 9, inclusive. I do not know that you want me to take the time of the Committee to read that now.

Hon. Mr. McDUGALD: Have you made an estimate of the saving which would result in the handling of grain by the St. Lawrence route to Montreal following the deepening of the St. Lawrence canals?

Mr. HENRY: I have.

Hon. Mr. McDUGALD: Would you explain how you arrive at that?

Mr. HENRY: Based on this time study of 1921, and a further time study of 1926.

Hon. Mr. MURPHY: Are you speaking now of some other report or of the one you made for the information of this Committee?

Mr. HENRY: This cost study was not made by the Grain Elevator Committee, it was in connection with another investigation I was making. Some of the figures that were used in that investigation I happened to have available. But it is based primarily upon the information contained in that report, supplemented by a further time study in the year 1926. I have here a tabulation which indicates that a possible saving of 3 cents a bushel might be expected following the completion of the Welland Canal and the lower St. Lawrence Canals. (*See Table No. 1, page 242.*)

Hon. Mr. SMITH: Is that the saving, comparing the cost when the waterway is finished with the cost now?

Mr. HENRY: That is correct. But I might say that it is based upon the present index number, the present general basis of rates. Nobody can forecast what the rates are likely to be in the future as a general proposition.

Hon. Mr. CASGRAIN: Take the rates of last summer, for instance.

Mr. HENRY: I took the average from 1922 to 1926, and so far as the rate on the upper lakes is concerned, this has the effect of increasing it slightly over what it was in 1926; but so far as the rates between Port Colborne and Montreal, the figures I am using here are approximately the average which obtained during 1926.

Hon. Mr. McLENNAN: These are all rates. We have had some figures given to us on cost.

Mr. HENRY: These are based on rates and not costs directly.

Hon. Mr. CASGRAIN: About what was the cost last summer?

Mr. HENRY: These figures were made for 1926.

Hon. Mr. CASGRAIN: The rates?

Mr. HENRY: These figures were based on 1926. The rates were 9.22 cents a bushel. I do not think I have them for last summer. They are not very different.

Hon. Mr. REID: If there would be 3 cents per bushel saving when the canals are all completed, how much less will the rate be, pending the completion, when the vessels run through the Welland Canal to Kingston or Prescott?

Mr. HENRY: As near as I could estimate, I would say probably a cent or perhaps a cent and a quarter.

Hon. Mr. REID: That would mean that from there down it would be about $1\frac{3}{4}$ cents further saving when the other is completed?

Mr. HENRY: Probably. I am going to deal with the question of rates a little later on, and will tell you the reason why.

The CHAIRMAN: You were going on to give us some figures.

Mr. HENRY: This analysis is based upon, first, a consideration of the rates which obtained during the period 1922-1926. The reason for taking this period is that there may be conditions obtaining in any year you might choose which might be influenced by factors which in the long run would be considered abnormal, and the results obtained by using those figures would not be very accurate. I have taken these rates, which for the average amount to 3.5 from the head of the Lakes to Port Colborne, and 6.1 from Port Colborne to Montreal. That is a total of 9.6. I have divided those rates up into various factors: first, the rate from Port William to Port Colborne has been divided into the shovelling charge, which costs at Port Colborne .435 cents. The hull insurance which costs .265 cents. That is to say the rate has to absorb .7 cents, which leaves a balance of 2.8 cents.

This 2.8 cents has been further divided into two factors: the factor due to running time and the factor due to terminal delay, the terminal delay having been arrived at by an analysis of the 1921 and the 1926 figures. The portion of the rate which I have assessed against the terminal delay is .65 cents. That leaves a balance for running time of 2.15 cents.

I have then translated this 2.15 cents into cents per ton mile, and it works out at .08 cents per ton mile, the idea being to find out the influence of distance and sailing time under the two sets of conditions.

Taking the same procedure with respect to the Port Colborne-Montreal rate, I find that the absorptions, which consist of shovelling, elevation and insurance, amount to 1.44 cents. That leaves 4.66 cents. The terminal time is equivalent to .96 cents, leaving the amount for running time at 3.7 cents. This is equivalent to .16 cents per ton mile.

I would like to file that statement for the information of the Committee. (See Table No. 2, page 243.)

Then I took the sailing time which occurred in these two years, and divided it, eliminating the time which was involved in terminal delays, and reduced it to equivalent distance—that is to say, an allowance for the restricted channel and the lockages—and when I came in to the completed canal I did the same things, but I had to estimate the time it would take to lock the boats through the larger canal. I took that to be one hour. That takes into account the average time consumed from the time the boat starts to slow down ready to warp into the lock until she gets out at the other end. To substantiate this estimate I took a record of the time which the Canadian Government Merchant Marine boats had actually taken to tack through the Panama canal locks. That works out at approximately an hour. After dealing with the matter on that basis, I find that the equivalent distance from Port Arthur to Port Colborne is 900 miles, and the equivalent distance from Port Colborne to Montreal, 770 miles.

900 miles at .08 cents per ton mile equals 72 cents per ton; 770 miles at .16 cents per ton mile equals 123.20 cents per ton, or a total of 195.20 cents per ton for the total movement. That is equivalent to 5.85 cents per bushel.

The cost through the new enlarged canal, I figure, would be equivalent to 1,440 equivalent miles at .08 cents, or 115.2 cents per ton. That is equivalent to 3.45 cents per bushel. There is, therefore, a saving of the difference between 3.45 cents and 5.85 cents to which has to be added the transfer charge which I have estimated at .6 cents, bringing it up to a total of 3 cents.

Hon. Mr. McDougald: Will you explain the factors controlling rates in the territory affected by the St. Lawrence waterways?

Mr. HENRY: Some little time ago I was asked in another connection to write a memorandum on this topic, which probably might be of information to the Committee. If you will permit me, I will just read it:—

The rate question, from the standpoint of transportation by rail and by water, and its relation to the cost of performing the transportation service has been the subject of continuous controversy between the shippers on the one hand and the transportation companies on the other, and for a long time was governed by the law of supply and demand, or what the traffic would reasonably bear. In the course of time, regulatory bodies have grown up in Canada and the United States for the purpose of regulating, amongst other things, the rates charged by railways operating as public carriers. The same conditions, however, do not obtain in the case of water carriers, either on the ocean or on the Great Lakes. So far as rates are concerned, these carriers are not subject to any regulation whatever, and therefore the law of supply and demand is the controlling influence in the establishment of rates. Naturally, therefore, rates charged for carriage by water vary greatly even from day to day, whereas rates charged by steam railways are of a much more stable character because of the influence of regulating bodies.

An analysis of the rates charged by the carriers on the Great Lakes and those engaged in the movement of traffic through the canals indicates that during the periods of peak movement these carriers charge a rate which is considerably in excess of the cost of performing the service, and, in fact, represents substantially what the traffic will bear. On the other hand, during the slack periods, the limiting consideration in establishing rates appears to be the amount required to pay the actual out-of-pocket expenses due to the operation of these vessels; in other words, the difference between the cost of running and the cost laid up. In the final analysis, however, the adverse amount which the lake and canal carrier receives for the transportation service performed must be sufficient to pay all operating charges, all interest charges, and provide a margin of profit—otherwise there would be no incentive to continue in the shipping business—so that there is necessarily over a reasonable period, a definite relation between the cost of performing the service and the rate charged, viewing the matter in the large.

The general rate structure at present in effect on the steam railways in Canada and the United States is very complicated and has been the outcome of the blending of a large number of influences, such as water competition, other types of competition, commercial considerations such as the maintenance of industries in certain territories by equalization of rates, the relationship of the cost of transportation, and many other influences; but, broadly speaking, the average rate charged is designed to provide for the entire cost of operation plus a margin of profit.

In regard to railway rates on grain from Lake and Bay ports to Montreal and Atlantic ports, it is safe to say that the Buffalo to New York rate has been the controlling influence, because of the fact that the mileage between Buffalo and New York is shorter than the mileage

from any other Lake Erie or Bay port to the seaboard. This distance is 396 miles. The rate on export wheat presently in effect—
This was written a year ago.

—between Buffalo and New York is 15·17 cents per 100 pounds—
That is about 9·1 cent per bushel.

—the rate on export wheat from the Bay ports to Montreal is 14·34 cents per 100 pounds—
That is 8·7 cents per bushel.

—and the rate on export wheat from the Canadian Lake ports to Halifax, St. John, Portland and Boston is 15·17 cents (the same as that obtaining to New York from Buffalo) but there are no rates quoted, and consequently no movement of grain, from the Bay ports to New York. It is but fair to point out that the absorptions in each case are not the same; that is to say, in some cases elevator charges are included in the rate, whereas in other cases they are not. The Buffalo-New-York rate absorbs not in excess of 1 cent per bushel out of their charges at Buffalo and also elevating or dumping charges in some cases in New York. The rate from the Bay ports to Montreal includes elevator charges at the Bay ports and Montreal. The rate from the Bay ports to the Atlantic seaboard includes only the elevator charge at the Bay ports.

Broadly speaking, that is the reason why, instead of using the figures of 1926 in this analysis, I used the figures for the four-year period.

Hon. Mr. REID: What is the difference on grain from say Port Arthur to Montreal via bay ports and via all water in any one season? In any one season the rail rate from the Bay ports to Montreal closely approximates 8·6; it is 8·67 cents plus anywhere from 2½ to 3½ cents for water carriage to the Bay ports. The rate the other way all water is—this average worked out at 9·6.

Hon. Mr. REID: Probably about 2 cents.

Mr. HENRY: So it might be anywhere from 2 cents down to a cent. They vary from time to time.

Hon. Mr. REID: Do you include in the 9·8 the elevator charges?

Mr. HENRY: Oh, yes, everything is included.

Hon. Mr. REID: That is a fair comparison?

Mr. HENRY: That is a fair comparison.

Hon. Mr. REID: About 1½ or 2 cents.

Hon. Mr. CASGRAIN: It is about \$3 a ton.

Mr. HENRY: Nine cents a bushel is approximately \$3 a ton. There are 33½ bushels to the ton.

Hon. Mr. REID: Mr. Henry, could you say offhand what the rate of freight would be by rail from Prescott to Montreal?

Mr. HENRY: From Prescott to Montreal, there is no criterion upon which to base that rate, Senator.

Hon. Mr. REID: I will tell you why I ask that question. When they were building the Welland Canal, before they enlarged it, there was an elevator put up at Prescott and the C.P.R. carried a great quantity of the grain down by rail from Prescott, and I think the rate was 7 cents a hundred pounds.

Mr. HENRY: Oh, yes, that is correct, 7 cents a hundred pounds. I have the rates here—domestic rates.

Hon. Mr. REID: About 4 cents a bushel. But that was when there were small trains, etc. I was wondering if the rate would not be less now.

Mr. HENRY: That was in 1908. The rates would be more now.

Hon. Mr. REID: You think they would?

Mr. HENRY: I think so.

Hon. Mr. REID: I thought that when the cars were smaller——

Mr. HENRY: Well, you have to bear this in mind, that the railway in the first place has to pay three-quarters of a cent to the elevator, and it has to pay six-tenths of a cent to the elevator at Montreal: so there you have approximately one and a half cents.

Hon. Mr. REID: So have the boats too.

Mr. HENRY: The boats pay a little less than the railways. They pay at Port Colborne \$4.35 a thousand, shovelling, and \$2, elevating.

Hon. Mr. REID: I mean, they pay elevator charges at both ends at the 7-cent rate.

Mr. HENRY: Yes.

Hon. Mr. REID: I am surprised to know that the rates would be more now.

Mr. HENRY: If you are looking at 1908 let me say right here that the relative basis of cost is at least 60 per cent more than in 1908.

Hon. Mr. REID: Yes, but then the tonnage you carry is probably 100 per cent more, or 200 per cent more. Then there were 25 tons in a car.

Mr. HENRY: There are 40 now.

Hon. Mr. REID: I mean, you carry so much more that I did not think the rates would be more.

Mr. HENRY: The reason is this, that having regard to the length of haul, the terminal costs are so serious. They are just as much whether the haul is 100 miles or 1,000 miles. One of the reasons that the rates in the West can be as low as they are is because the average haul is 910 miles. In other words, when you get the grain into the car you haul it 910 miles before you have to do any switching.

Hon. Mr. REID: Yes, but the car goes back empty, 910 miles. Here you go back and forward so quickly.

Mr. HENRY: It does not make any difference.

Hon. Mr. McLENNAN: The terminal cost, in and out, in proportion is very much greater on the short haul than on the long?

Mr. HENRY: Yes. Sometimes it is more than the entire haul.

Hon. Mr. McLENNAN: Have you considered whether if you had a large trade developed at Kingston, Prescott, or wherever it may be, to Montreal, for export, the present rates could be much reduced? Could they come anywhere near the water rate?

Mr. HENRY: Well, the combination of the rates would probably be equal to the present water rate—probably.

Hon. Mr. McLENNAN: Yes, that is what they would make it?

Mr. HENRY: Probably. But there is another factor which has to be taken into account in considering what that rate ought to be, and that is the Buffalo-New York rate.

Hon. Mr. McLENNAN: That controls it?

Mr. HENRY: Naturally, we might succeed in upsetting the whole rate structure down below.

Hon. Mr. McLENNAN: Of America?

Mr. HENRY: Of America, and that is why I say I would not like to venture an opinion as to what the rate actually would be. That would be a question which would have to be determined by the Board.

Hon. Mr. McLENNAN: If we set a low rate, the chances are that Buffalo and New York would not lose the business.

Mr. HENRY: There would be a tendency for them to bring it down to the water rate.

Hon. Mr. CASGRAIN: But, Mr. Henry, there is quick loading at the elevator. The loading does not take long. When the grain comes to Montreal there is that machine to dump a car right out.

Mr. HENRY: But, you see, in order to marshal your cars—you load different classes of grain—they have to be all switched in rotation so that they will be in proper order to take to a certain elevator, and you know the terminal facilities at Montreal are rather difficult of operation. The deliveries to the harbour are difficult.

Hon. Mr. CASGRAIN: I thought they were very easy.

Hon. Mr. McLENNAN: Have you another question to ask, Senator McDougald?

Hon. Mr. McDUGALD: What effect would the deepening of the St. Lawrence have upon the traffic of the railways of Canada, Mr. Henry?

Mr. HENRY: My opinion about that might probably be illustrated by a consideration of what has happened these last two or three years. I have here some figures which might illustrate that. In the year 1923 the quantity of grain delivered by the railways at Montreal amounted to 45,000,000 bushels. The amount received by water, that is, from the upper lakes, was 74,000,000. In 1924 the quantity handled by railway was 53,000,000, and by water 112,000,000. In 1925 the rail shipments dropped to 39,000,000 and the water shipments had risen to 124,000,000. In 1926—this was a smaller year anyway—the rail shipments had dropped to 31,000,000 and the water shipments to 105,000,000. In 1927 the amount received by rail was a little higher, 35,000,000, and by water it was 154,000,000. So my answer to your question would be this: there would probably be a drop in the rail handlings of grain for export, but in addition to the grain handled for export there is a substantial volume of grain which is consumed domestically or milled into flour from the Bay Port area. I think my memory is right when I say that on the average 25 millions of bushels are distributed from that area for milling and domestic purposes.

Hon. Mr. McLENNAN: To millers mostly?

Mr. HENRY: To millers for milling purposes. In addition to that there is a substantial amount which is handled through those Bay Port elevators for U.S. domestic purposes. Just what that amounts to varies from time to time, but it might run as high as 10 or 12 millions of bushels.

Hon. Mr. McLENNAN: That is from the Bay Ports?

Mr. HENRY: I am talking about the Bay Ports.

Hon. Mr. McLENNAN: How does it get into the States?

Mr. HENRY: Well, we handle it by rail from Depot Harbour to the New England points.

Hon. Mr. McLENNAN: New England points?

Mr. HENRY: From Depot Harbour and Midland, chiefly. There would be a compensating factor, I think, because the St. Lawrence waterway would enable a larger amount at a cheaper rate, of lower grade commodities, and that would mean that industries, marginal industries as we call them in economics, would

be able to develop. They are not able to develop now, because of the fact that the transportation charge is so great in relation to the total value of the product that they cannot afford to embark on it.

Hon. Mr. McLENNAN: Why do you call them "marginal industries"?

Mr. HENRY: I say they are marginal because they can only afford to operate on a low basis of cost. When the cost rises they cannot, and the transportation in those instances—low-grade commodities—there are lots of them—is a very important factor.

Hon. Mr. REID: One question with reference to those rates. When you say the rate is 9 cents from Bay Ports, is that a through rate?

Mr. HENRY: It is 8.67.

Hon. Mr. REID: Is that the amount the railway receives on the through shipment from Port Arthur, say, to Liverpool, or is that your local rate?

Mr. HENRY: No, this is the export rate. The local rate is higher.

Hon. Mr. REID: All right.

Mr. HENRY: This is the export rate.

Hon. Mr. MURPHY: Mr. Henry, you answered the last question asked you with reference to the effect on the railways of the deepening of the St. Lawrence waterway, from the standpoint of a C.N.R. official.

Mr. HENRY: I am only speaking, of course, from the standpoint of the C.N.R.

Hon. Mr. MURPHY: Just on that point, I was going to ask you, if the same question were addressed to a representative of the C.P.R., would he in his reply, do you think, deal with the same set of figures and arrive at the same result?

Mr. HENRY: I am inclined to think he would have to deal with the same set of figures, because these are the official figures.

Hon. Mr. MURPHY: Yes.

Mr. HENRY: But there is another factor that enters into it, quite apart from that, Senator, and it is this—

Hon. Mr. MURPHY: The question asked you was in the plural: What was the effect on the "railways"?

Mr. HENRY: The Canadian National Railways.

Hon. Mr. McDUGALD: Would you rather limit that to the Canadian National? I was talking in general terms, in a general way, in asking if he would say whether or not it had any adverse effect.

Hon. Mr. MURPHY: That is why I am differentiating.

Mr. HENRY: I think perhaps I had better confine my remarks.

Hon. Mr. McLENNAN: Your rates are competitive.

Mr. HENRY: These rates are competitive.

Hon. Mr. CASGRAIN: If I understand you, Mr. Henry, you think that big canals can do a transport trade as cheaply as small ones, eh? That is what you think?

Mr. HENRY: Oh, yes.

The Committee adjourned until 4 o'clock in the afternoon.

AFTERNOON SESSION

The Committee resumed at 4 o'clock, p.m.

Mr. R. A. C. HENRY (Recalled): Just before we rose at noon, Senator Casgrain asked me a question which I did not quite understand. It related to the difference in costs per ton capacity between barges and power boats. I thought he was talking about the difference in costs between the upper and

lower laker. I have not any of the figures as to the tonnage cost, but I do know that the barges either have not any power or their power equipment is of very much less capacity, therefore the cost per ton capacity is very much less. Of course they move at a much lower rate of speed, and while that does not make very much difference in the canal itself, it does in the reaches between, and in the open water. I think I have some figures here regarding the relative costs of the upper and lower laker. These are two or three years old, and they may not apply at the moment, except the relative position. Two or three years ago the cost of the 2,400 capacity canal-sized boats was \$80 the cargo ton, that is, a capacity ton, and the rate of the upper laker was \$62.50. But when you come down to the barges I should think that the cost would run perhaps from \$40 down, maybe to \$20.

Hon. Mr. REID: Is that the cost of construction?

Mr. HENRY: This is the cost of construction. Of course the barges either have to have some motive power of their own or they have to be towed, and that means that the rate of speed is much less.

Hon. Mr. REID: I would like to ask you about one point there. Of course there is the large vessel that comes to Port Colborne, 10,000 to 12,000 tons, then from Port Colborne there is a vessel of 2,500 tons—

Mr. HENRY: They do not average that though.

Hon. Mr. REID: I mean roughly. I have seen them passing my house from time to time bringing grain from Port Colborne down in those vessels that they use in the Erie canal with Deisel engines; is there not a possibility of those vessels that now run to Port Colborne becoming antiquated, and those Deisel engine barges running from Prescott, Brockville or Kingston down during the time of construction, the next seven or eight years—because they carry about 50 per cent more, and they are a cheap barge vessel, with five men operating?

Mr. HENRY: Yes, they are relatively cheap. Of course they are slow-moving.

Hon. Mr. McLENNAN: But that isn't much for 100 miles.

Mr. HENRY: No.

Hon. Mr. REID: To-day a vessel carries 80,000 bushels from Port Colborne, and I am told that these vessels will carry 120,000, 50 per cent more, with those Deisel engines, and they are a cheaper construction and have a cheaper crew.

Mr. HENRY: Unquestionably.

Hon. Mr. REID: They have to go only 120 miles, therefore we should get some advantage from them during the 6 or 7 years.

Mr. HENRY: If you were to make all the boats in the canal trade of 80,000 capacity you would be able to increase the present capacity of the canal, but in order to do that you would have to scrap a lot of the smaller boats, and the probability is that the new ones would not amortize themselves out of earnings in the time that is left prior to the enlargement of the canal.

Hon. Mr. REID: But what I mean is that the very minute you get down to Kingston, Prescott or Brockville, say in 1931, we will have to use the present system until the other is built.

Mr. HENRY: Yes.

Hon. Mr. REID: But then that other system should give us a cheaper transportation.

Mr. HENRY: I would have to look into that before I would be able to say you would get a 50 per cent greater capacity on a boat of that kind. You see you have your displacement.

Hon. Mr. McLENNAN: The only thing is the difference in the weight of the engine.

Mr. HENRY: No, there is a different bottom, a flat bottom and other different conditions.

Hon. Mr. REID: The vessel men have compared it with the Erie canal vessels, which are much smaller, but they carry a greater cargo to-day, and the only point is that we should get the advantage of those vessels until the other is built.

Mr. HENRY: They have an increased capacity of 50 per cent; you are quite right.

Hon. Mr. McDUGALD: But would you be able to get anybody to build enough of those boats for a life of seven years?

Mr. HENRY: If you could induce anyone to build them for the time before they would have to be scrapped or used elsewhere.

Hon. Mr. REID: When the new canal system is built there will be quite a lot of traffic that will change at Prescott and Ogdensburg and go down by barges, or by that kind of vessel—not go right through to Montreal, because the 12,000 ton vessel would turn and go right back to Fort William, and let it go down in those cheap ones, therefore they would not be put out of business altogether.

Hon. Mr. McLENNAN: Had we not better hear the witness and then ask him afterwards?

Hon. Mr. McDUGALD: I think the last question was, what effect would the deepening of the St. Lawrence have on the traffic of the railways in Canada. Did you finish that?

Mr. HENRY: I did not quite finish the previous one, Senator, if you don't mind.

Hon. Mr. McDUGALD: You mean the controlling of the rates?

Mr. HENRY: Yes. The memorandum which I read gave the general considerations which obtain in the rate structure within the sphere of influence of the St. Lawrence Waterways. Now, it has been so from the beginning of time that water transportation has always been cheaper than practically any other form. For that reason water transportation—that is, provided the facilities to get to land as the water transfer points are provided—has always controlled rates. The first reason for that is that the capital cost of the equipment is less. Even if you take the most expensive type of boat, there is no roadway to provide, that is, the facilities grading, bridges, etc.—which are required for the operation of trains, and which run anywhere from \$25,000 to \$75,000 a mile, do not have to be provided. In the third place, the cost of operation itself per ton is much less. You require less control on the line, and you require less operation. Just to give you an illustration on one of those points, take those two boats I was referring to—the first boat canal-sized, is about equivalent to a sixty-car train. Now a sixty-car train costs approximately \$214,000; that is, just the equipment.

Hon. Mr. McLENNAN: Including the motive power?

Mr. HENRY: Including the locomotive. That is probably a little less than an average sized train, but it costs \$89 a ton. Now, if you take an upper laker, which is equivalent, that is, a 12,000 ton boat is equivalent to four trains, 75 cars, the capital cost of which is \$1,000,000, or \$84 a ton. That gives you an idea of the relative cost of the equipment. Now, with regard to this particular territory, all rates, that is, rates that involve a movement either from the upper lakes to the seaboard or from the head of the lakes to any of the points on the lower lakes, such as Lake Erie points, such as Lake Ontario points, are affected by it. The railways are naturally forced if they

are coming into competition, to reduce their rates to something which is a bit above cost. The boats, on the other hand, wanting the business will make a rate a little lower than the railways can afford to carry it, and up to capacity, of course, they take the business. Now, from the railway point of view, the controlling factor is, and probably will be for some time to come, the Buffalo-New York rate. The reason for that is that New York is a liner port with great distributing area, and it has a short railway mileage from Buffalo, 396 miles, and because of the fact that they have got such a large liner tonnage coming in after the St. Lawrence has had all that can go out in tramps; they really have the first call up to the liner capacity. The liner capacity seems to be somewhere in the vicinity of 175,000,000 or 200,000,000 bushels out of New York. I say seems to be, because the ocean rates at times seem to affect that a bit.

Hon. Mr. REID: What is the rate on grain by rail from Buffalo to New York?

Mr. HENRY: 15.17 cents net; that is equivalent to 9.1 cents a bushel.

Hon. Mr. REID: Exactly the same as from Port Colborne to Montreal by water?

Mr. HENRY: No; the rate from Port Colborne to Montreal is approximately 6 cents.

Hon. Mr. REID: It is 9 cents all the way across?

Mr. HENRY: It is 9 cents all the way across.

Hon. Mr. McLENNAN: The rate is from inland points?

Mr. HENRY: Yes; they are more or less controlled by the Interstate Commerce Commission on one hand, and the shipping interests on the other not wanting to get the rate lower than cost.

Right Hon. Mr. GRAHAM: I suppose one reason why tramp steamers are liable to go to New York is because they can get return cargo?

Mr. HENRY: Tramps do not go to New York at all. The reason is the expense involved in the docking and so on, which is rather too great.

Right Hon. Mr. GRAHAM: Where do they go?

Mr. HENRY: To Baltimore and to Philadelphia. These are the tramp ports on the North Atlantic. Baltimore, Philadelphia and Montreal. There is very little tramp tonnage out of New York; normally it is from Baltimore and Philadelphia. It might be interesting to you to know that recently the Baltimore Chamber of Commerce had an application before the Interstate Commerce Commission to establish a greater differential below New York, on the general grounds that they were rather at a disadvantage on account of the commercial considerations which naturally influence traffic through New York.

Right Hon. Mr. GRAHAM: For the liners?

Mr. HENRY: For the liners. The Interstate Commerce Commission have not brought in their finding, but the examiner who heard the case recommended that the Interstate Commerce Commission should find "that the export rates on ex-lake grain in carloads, from Buffalo to Baltimore and Philadelphia, are unreasonable and prejudicial to Baltimore and unduly preferential to New York when they exceed rates that are 2 cents per 100 pounds less than similar rates to New York"; that is, 2 cents a hundred pounds, equivalent to 1.2 cents a bushel. That means that hereafter, if the Interstate Commerce Commission agree with the finding of the examiner, that instead of a half-cent a hundred differential, as now, it will be 1.2 cents.

Right Hon. Mr. GRAHAM: What is the reason that some of our Canadian traffic by rail will go to American ports for ocean transshipment in preference to a Canadian port—special cases?

Mr. HENRY: Well, the only case I know of is Portland. There might be a little go out of Boston, but there has not been very much moved out of Boston for a great many years that I know of. That is because some vessels have called at Portland, and they want a cargo, and they get a shipper to route American grain that way. Not very much went through Portland last year—I think about 4,000,000 bushels.

Hon. Mr. REID: Why was it that 140,000,000 bushels of Canadian grain went via Buffalo to New York for export last year when the rate is 2 cents a bushel less by the St. Lawrence?

Mr. HENRY: Well, the fact is that that grain came in late in the season, and you could not get it out by the St. Lawrence route. It was stored at Buffalo, either in the elevators or in boats afloat, and went out gradually during the winter. Montreal only has seven months navigation; that is the reason, and there are not any rates that are comparable from Montreal to the Atlantic port. If they are, they are about the same as the Buffalo rates, and any shipper having grain would have to pay just as much from Montreal for the balance of the trip as he paid from Buffalo, and there would be no advantage in taking it down for storage purposes. That is the reason.

Hon. Mr. McLENNAN: Is it not also that there are certain shipments that there is tonnage for in New York, and that there is not in Montreal?

Mr. HENRY: Yes, that is so. The shipments out of New York are reasonably regular. If you are interested in that I have probably data here on it which indicates pretty well the fluctuation.

Hon. Mr. McLENNAN: Have you anything about the relative tonnage of liner and tramp out of New York?

Mr. HENRY: No; the last time I looked into it there were very few tramps went out of New York. As a matter of fact during the war there were a few, but prior to the war there were none.

Right Hon. Mr. GRAHAM: When I knew more about it New York was full of them.

Mr. HENRY: Well, let me see.

Right Hon. Mr. GRAHAM: They are quite often shifting ports, and coming around to the St. Lawrence.

Mr. HENRY: I may have some information. I can give you those figures, but I have not separated them in these statistics as between tramp and liner.

Hon. Mr. WILLOUGHBY: Did I understand that the rate from Buffalo via New York to Europe would correspond with the rate to Montreal normally?

Mr. HENRY: It does not absolutely. The rate to Montreal is a little less. There is a differential of a half a cent per 100 pounds, the difference between 14 67 and 15 17. But that does not necessarily mean that the ocean rate from Montreal and New York are the same. They are not always. Now, answering your question, Senator, I have here a statement indicating the tramp and liner trade from the year 1904 to the year 1922. There were no tramps in the grain trade from New York between 1904 and 1911; in 1911 there were 800,000 bushels moved out; in 1912, 4,800,000; in 1913, 4,000,000; in 1914, 14,800,000; then they disappeared until 1922. During the early part of the war they were in. On the other hand, they have been in Philadelphia and Baltimore. In 1922 they handled 28,400,000 out of Philadelphia and 15,400,000 out of Baltimore.

Hon. Mr. McDUGGALD: Do you think the deepening of the St. Lawrence waterway would benefit the Western farmers, and if so, why?

Mr. HENRY: I think it would for the reason that, as Colonel Dubuc explained this morning, in the first place the capacity of the existing canal is

in danger of being reached in a very short time. If it is reached, that means that the water rate from the head of the lakes to Montreal, with respect to quite a substantial volume of grain at any rate, will not be governed by the cost of carriage by water, but will be governed more by the rate which the railways charge from the Bay ports and from Buffalo; and naturally it would tend to rise.

In the second place, the 3 cents to which I referred this morning could not be obtained.

In the third place, the situation affecting the farmer in the West is a little bit extraordinary. He is not now meeting that competition in the world markets which he did before the war, and will not, at least not to the extent he did before the war, as long as the producing areas in Russia are out of consideration as a competitor. The investment in land in Russia is, of course, much less, and the labour cost is much less, though transportation costs are a little bit worse. But on the average, before the war they could afford to sell their wheat at a much less rate than the Canadian farmer. So much for Russia.

Another competitor is the United States. They are not so much of a factor at the moment, because in the United States land values are higher and the transportation rates from the producing centres to the head of the Lakes are a little higher. But rather serious competition comes from the Argentine and Australia. The Argentine has a higher water rate, of course, but a less land haul. Taken on the average, the Western farmer is at quite a disadvantage with respect to the producers down there from the standpoint of transportation and the cost of labour, so that when Russia comes back into the market—and I think it is within the realm of possibility that Russia may come back within the next ten or fifteen years—it will be more difficult for the farmer in the West to compete on account of the long haul involved. The average haul in 1927 from the centre of production to the head of the lakes was 910 miles. That meant that every bushel of grain had to stand a transportation charge before it got to the head of the lakes of the equivalent of 910 miles. In terms of cents per bushel, that is approximately 14 cents to the head of the lakes. After that, even if he does take the waterway, he has got I think 1,215 miles to Montreal—Fort William to Montreal is 1,215 miles which costs a little over 9 cents per bushel. Then after that, of course, he has the rate from Montreal to the United Kingdom, where most of the grain is marketed at the present time which costs from 4.5 cents to 10.5 cents per bushel, or a total of from 28.5 to 33.5 cents per bushel. So I am inclined to think the waterway would be of substantial advantage to the farmer of the West.

Right Hon. Mr. GRAHAM: You would not like to state that in cents per bushel?

Mr. HENRY: Well, I said this morning, Mr. Graham, that I thought the deep waterway—that is the possibility of bringing those large boats down to Montreal—would make it possible on the present basis of prices to reduce the cost 3 cents. That is based upon a consideration of the actual time which was taken by all the boats that came down in 1921, and most of them that came down in 1926.

Right Hon. Mr. GRAHAM: Would that 3 cents apply as between present conditions and the conditions if the waterway were developed, or would it be 3 cents between the price of the large lake freighters coming down to the foot of Lake Ontario—

Mr. HENRY: No. That 3 cents is the reduction which I estimate would result on the present basis of prices from Port Colborne to Montreal, measuring that by a consideration of the rates which are now charged by the upper lakiers to Port Colborne and those now charged by the canal sized boats from Port Colborne to Montreal.

Right Hon. Mr. GRAHAM: Professor Goforth yesterday expressed the view that between the present conditions—that is before the Welland was completed—and the conditions that will prevail after the St. Lawrence is developed, the saving would be from 4 to 5 cents; but as between the conditions that would prevail when the Welland was completed and large lakers could come to the foot of Lake Ontario and Montreal, the saving would be from 2 to 3 cents a bushel.

Mr. HENRY: Well, I think perhaps, without actually going into it, that I would be inclined to divide that 3 cents into $1\frac{1}{4}$ cents down to either Kingston or Prescott or Gananoque, and $1\frac{3}{4}$ cents for the balance of the way. But bear this in mind, that out of the $1\frac{3}{4}$ cents you have the terminal charge. Eliminating that, it would be pretty nearly fifty-fifty.

Right Hon. Mr. GRAHAM: There is this situation. At present we transship at Port Colborne through the Government elevator.

Mr. HENRY: Yes.

Right Hon. Mr. GRAHAM: A good deal of the grain goes to Buffalo; but it is a mistake to think that all the grain that goes to Buffalo goes to New York, because quite a proportion of it is reshipped and comes back to Montreal.

Mr. HENRY: Down to Montreal.

Right Hon. Mr. GRAHAM: But even when the large vessels come through too, I will be kind enough to my friend to my right (Hon. Mr. Reid) to say Prescott, we will still have the transshipment charge at Prescott which we would not have if the boats went through to Montreal.

Mr. HENRY: That is correct.

Right Hon. Mr. GRAHAM: There will be one transshipment charge extra?

Mr. HENRY: Yes. My 3 cents included approximately .6 cents for transshipment charge, so if you will eliminate that it will be about $1\frac{1}{4}$ cents each way.

Hon. Mr. REID: Is it your impression that Atlantic liners will go right through to Port Arthur for cargoes?

Mr. HENRY: I do not believe any liner will go up at all. You might have an odd tramp that would go up. I do not think the liners would go, because they usually go from large centres to large centres.

Right Hon. Mr. GRAHAM: It has been generally conceded by everybody who has appeared before this Committee, as you say, that probably regular liners would not go west of Montreal. Tramps might; coasting vessels might. But in the main, the benefit to be derived by the St. Lawrence waterways development would be that large ships would go from Fort William through to Montreal without transshipment.

Mr. HENRY: That is right.

Right Hon. Mr. GRAHAM: The rate at which they could carry their grain through in large quantities to Montreal would depend somewhat on the activity of the Montreal Harbour Commission in seeing that they had return cargoes.

Mr. HENRY: And in giving them despatch in unloading.

Right Hon. Mr. GRAHAM: In dealing with all freight rates, either by rail or by boat, one of the factors which we often forget is the influence that return cargoes have on the rates.

Mr. HENRY: A very great influence.

Right Hon. Mr. GRAHAM: If a vessel going to Montreal had to return empty you would have to have the shipment to Montreal carry the overhead of the return empty of the vessel?

Mr. HENRY: Absolutely.

Hon. Mr. McLENNAN: They have practically got to be paid for a voyage of 2,400 miles instead of 1,200 miles?

Mr. HENRY: That is right.

Right Hon. Mr. GRAHAM: The same thing applies to ocean tonnage?

Mr. HENRY: Oh, yes.

Right Hon. Mr. GRAHAM: When we are figuring the out-of-pocket cost of railways for hauling a train from the West to Montreal, or for hauling coal from Alberta to Ontario, we cannot take the out-of-pocket expenses one way.

Mr. HENRY: Oh, no.

Right Hon. Mr. GRAHAM: You have to add what it will cost to take the empties back.

Mr. HENRY: Absolutely. The costs which I analyzed and which I was dealing with were not costs so much as they were rates, Mr. Graham. I divided the rates into the various elements—terminal charges, terminal delays and running time—assuming they would have the same load factor as they have now; but I do not think it would be a stretch of the imagination to anticipate a better balance than has occurred in the past.

Right Hon. Mr. GRAHAM: Does not this result from your calculations, as well as that of others: that the greater development we can have, say, in the Harbour of Montreal, or in the Harbour of Quebec, in inducing freight to come from across the ocean, the greater will be its influence on the freight rates for our products for export?

Mr. HENRY: Unquestionably.

Right Hon. Mr. GRAHAM: So we ought to keep in mind the importance of these ocean ports—Halifax, St. John, Montreal, and Quebec—and their development to handle inbound freight as well as outbound freight.

Mr. HENRY: Oh, yes; unquestionably.

Right Hon. Mr. GRAHAM: Would not this follow, then—stop me if I get too loquacious—would not this follow: If the development of the St. Lawrence were made so that ships could go through to Montreal or Quebec, there would be a greater probability of their having a return cargo than if they had to stop at either Brockville or Prescott or Kingston?

Mr. HENRY: Oh, yes.

Right Hon. Mr. GRAHAM: Once freight is transhipped to rail for Montreal or Quebec, it goes by rail all the way through?

Mr. HENRY: Absolutely.

Right Hon. Mr. GRAHAM: But if those ships could go through to real ocean ports, they would be able to develop a return cargo that they cannot get under present conditions?

Mr. HENRY: I think that is quite correct.

Right Hon. Mr. GRAHAM: May I ask a question point blank? You need not answer unless you like. That being the case, and it being conceded generally, I think, that regular freighters are not liable to go west of Montreal very much, the development of the St. Lawrence would bring from the west to Montreal, and from the east to Montreal, a greater activity than it has at the present time?

Mr. HENRY: Well, is it my opinion you want?

Right Hon. Mr. GRAHAM: Yes.

Mr. HENRY: I am quite willing to express an opinion upon that. It is my opinion that it will. I cannot see how it could fail to do so.

Right Hon. Mr. GRAHAM: We are looking to Quebec and St. John and Halifax to have a great development during the winter months, but Montreal at present, so far as the East is concerned, is a great port, and has no superior on this continent?

Mr. HENRY: No superior.

Right Hon. Mr. GRAHAM: And to my mind anything that we may do—and I think it is confirmed by all the evidence we have heard—in the opening up of greater facilities for traffic west of Montreal, will redound to the benefit of Montreal as well as to the rest of Canada?

Mr. HENRY: As well as the country at large.

Hon. Mr. McLENNAN: The honourable gentleman from Brockville is leading the witness.

Right Hon. Mr. GRAHAM: I know the witness very well—

Hon. Mr. McLENNAN: Does that mean that he is easier to lead?

Right Hon. Mr. GRAHAM: No. I consider Mr. Henry, who is now giving us information, one of the best posted men on the continent of America on the question of economics and the handling of traffic.

Hon. Mr. McLENNAN: I have no doubt about that.

Hon. Mr. McDUGALD: In effect, the National Advisory Committee recommended that the United States Government pay the whole cost of the International Section, and that the Canadian Section be undertaken at the expense of power; the Federal Government and thereby navigation being thus relieved from any expense other than that involved in the maintenance and operation of the canals after completion. Under these circumstances do you think that the completion of the St. Lawrence canals would be in the interest of navigation?

Mr. HENRY: Oh, I do not think there is any question about it.

Hon. Mr. McDUGALD: Do you think that the deepening of the St. Lawrence waterway would adversely affect the port of Montreal? That is what Mr. Graham was asking you. Would you give reasons for it?

Mr. HENRY: Well, I think that Mr. Graham has given the reasons pretty fully now. I agree with the suggestions which were contained in his remarks. I do not think there is anything I could add to that except to say that the industrial development which would—

Hon. Mr. McDUGALD: I was going to ask you about that in the next question.

Mr. HENRY: —which would go on concurrently, would also have an influence quite apart from the fact to which he referred.

Hon. Mr. McDUGALD: The next question was, what benefits do you think would accrue to the tributary territory by reason of the power developments which would result?

Mr. HENRY: That is rather a poser.

Right Hon. Mr. GRAHAM: Henry is canny. I think he must be Scotch, although I am not sure.

Mr. HENRY: But I thought when I got a telegram from the Chairman of the Committee, referring to the possibility of your asking me a question of that kind, that I had better get some figures together.

The CHAIRMAN: I suppose you are not wholly unprepared.

Mr. HENRY: At the outset I might say that I have never made any estimates as to the industrial development which would follow the development of power, the reason being that it is rather difficult to estimate in advance the influence of the various factors which these large developments would bring about; but I thought that the Committee might be interested in looking at some figures of what has actually taken place in perhaps the most industrialized section anywhere in the world, and that consists of the States of New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois and Michigan. Those States in 1925 had a population of 45,000,000. They had primary horse-power employed in industry

to the extent of 19,145,000. Looking back at the situation from 1900, the population of those States in 1900 was 29,572,000, and the horse-power was 5,176,000. In 1910 the population had increased approximately 5,000,000, to 34,000,000, and the horse-power had increased from 5,000,000 to 9,000,000. In 1920 the population had increased from 34 to 41 million, and the horse-power from 9 to 15 million. From 1920 to 1925 the population had increased from 41 to 45 million, and the horse-power from 15 to 19 million.

Looking at that another way, the industry is measured in 1900 in the following fashion: Wages, \$1,146,000,000; cost of materials, \$3,773,000,000; value of products, \$6,601,000,000. In 1925 those figures were: Wages, \$6,465,000,000; cost of materials, \$20,362,000,000; value of products, \$36,577,000,000.

These States are rather peculiarly situated, because they either lie adjacent to or they actually contain very large resources in coal, coal in most of these cases being the source from which the power is developed.

Now I am not suggesting that the rate of progress along the St. Lawrence would equal this, but I am merely pointing out what has happened in the country to the south of us, where they have had a large amount of power developed, and it has doubled within the last fifteen years. I would like this statement put in (*See Tables Nos. 3 and 4, pages 243-4*).

Hon. Mr. McDougald: The last question that I have, Mr. Henry, is: In your opinion, should the improvement of the St. Lawrence waterway be gone on with as soon as possible, and, if so, why?

Mr. HENRY: Well, as I stated this morning, the capacity of the existing canals being within measurable distance of being reached, and inasmuch as any improvement undertaken would involve several years before it could be in operation—

Right Hon. Mr. GRAHAM: You mean by "improvement" the development?

Mr. HENRY: Yes.

Right Hon. Mr. GRAHAM: The waterway scheme?

Mr. HENRY: The waterway development. The full effect of the waterway in a reduction in rates, on account of its having reached its capacity, will not obtain. Some relief will have to be provided.

Right Hon. Mr. GRAHAM: In the meantime?

Mr. HENRY: I mean, it would have to be started right away.

Right Hon. Mr. GRAHAM: If the waterway development scheme is approved and goes on, in the time that will elapse between now and the date when that will become available we shall have to make certain improvements on our own canals to take care of the increase in the traffic?

Mr. HENRY: It might be desirable to do that, Mr. Graham.

Right Hon. Mr. GRAHAM: You need not answer these questions unless you like—

Mr. HENRY: I do not know what improvements of that kind would cost.

Right Hon. Mr. GRAHAM: We had that fairly well from Colonel Dubuc this morning. There is a factor that has arisen in our discussion. You and Colonel Dubuc and these other gentlemen have been giving us just the information that we have been after about these things. The question has arisen as to the competition that may arise on account of development at Oswego, or, say, at Albany, both as to water transportation and as to short rail haul. Now, what is your view of that as it has an effect on our development of the St. Lawrence waterway?

Mr. HENRY: Due to the improved facilities provided, in elevator capacity, both at Montreal and at Port Colborne, we have been able in these last few years to influence the traffic through that channel, because it is demonstrated to

the shipping world that it is a reliable channel. If anything happens to congest it, it is altogether probable that the grain will find other outlets and that it may be rather difficult to get it back. That is just a general statement.

With regard to Albany—you refer to Albany—I was down there last summer for the purpose of seeing whether any development was going on, and I found that the port authority of Albany—I am not sure of the exact title of the body there—were engaged in some dock construction, and I was told then that some funds had been provided by the United States Federal Government for dredging the river. If my memory serves me right, the distance from Oswego to Albany is something like 180 miles.

Right Hon. Mr. GRAHAM: It was stated that the distance was 120 miles, but I thought that was a little short.

Mr. HENRY: But the idea the interests down there have is that it would permit of a tramp movement. A tramp movement, on account of the great expense in getting into the Port of New York, was rather out of the question, but if a tramp could come up to Albany and unload a cargo there, it is contended, and I am inclined to agree with it, that they could successfully compete with the New York movement, on account of this difference in haul. You see, the difference in rail haul is probably 200 miles.

Right Hon. Mr. GRAHAM: That is rail haul?

Mr. HENRY: Yes, rail haul. It is 396 miles by the shortest line from Buffalo to New York, and that is the controlling influence. It is only about 30 to 75 miles shorter to New York by Clayton, Oswego or Ogdensburg, and in the evidence which was presented before the Interstate Commerce Commission a year or so ago by the Port of Oswego, in an attempt to get the Interstate Commerce Commission to force the railways to put in a rate lower than that from Buffalo to New York, the Interstate Commerce Commission took the view that that could not be done. They made the rate the same, the reason being that the railways had all their facilities at Buffalo and they would have to improve their grades. The distance hauled was only 75 miles less, and it would not justify them in quoting a lower rate and forcing the railways to improve facilities there to handle the business. But if a port is established at Albany that situation would be entirely changed and it is quite possible the Interstate Commerce Commission would force a rate from Oswego to Albany much lower than 15 cents a hundred.

Right Hon. Mr. GRAHAM: You know, Mr. Henry, that when the construction of a new Welland Ship Canal was being discussed several objections were made to it on the ground that it would afford facilities to carry grain to Oswego, and that we in Canada would lose the traffic at Oswego, as it would go through to Albany or New York. So far as water transportation is concerned, the engineering difficulties are so great that, as I remember the data, it would be impracticable for them to compete with us. But now it is proposed by some that they utilize the Welland Canal to get to Oswego, and then they have a short rail haul to Albany, of 180 miles, and by that route they could be real competitors with the Port of Montreal even if we had the waterways, but much greater competitors if we did not have the waterways development for Montreal. What is your idea of that, if you care to give it?

Mr. HENRY: I am inclined to think that there is a good deal in that; more of a factor, as you say, if we have not the advantage of the deeper waterways. If the traffic offering in the next few years greatly exceeds the capacity of the existing canals that would induce them, I think, to build it up.

Right Hon. Mr. GRAHAM: At the present time, of course, we carry through to Montreal, in either Canadian or American bottoms, a very large tonnage of traffic that originates in the United States.

Mr. HENRY: Oh, yes.

Right Hon. Mr. GRAHAM: Some of our people seem to forget, in pointing out that the United States get a lot of our grain traffic, the fact that we get a lot of their grain traffic through our own ports.

Mr. HENRY: Oh, yes, we do.

Right Hon. Mr. GRAHAM: It is dangerous ground to get on, if people would only think of it in discussing the question, because we might lose more than we would gain in taking that ground. Now, if we could make the port of Montreal a safe and sure competitor with the best that our friends on the other side could devise, would it not be a good thing for our Canadian trade and for Canada generally?

Mr. HENRY: Unquestionably.

Hon. Mr. REID: Mr. Henry, you said a few minutes ago, in your reply to the question of Dr. McDougald, that if the recommendation of the Advisory Committee were carried out it would be of course of great advantage to Canada.

Hon. Mr. McDUGALD: To navigation.

Hon. Mr. REID: To navigation. Now, that report of the Joint Board of Engineers placed part of the improvements on the American side, and Mr. McLachlan, if I remember rightly, stated in his evidence that they could be put on the Canadian side with equal results, with this exception, that it would cost three and a half million dollars more. In your opinion would we have the same results if the improvements were placed on the Canadian side, or was your answer merely as to what would be the effect if they were placed on the American side?

Mr. HENRY: I do not think it makes a bit of difference to my answer. I am assuming that they would be constructed and that navigation would not have to pay tolls.

Hon. Mr. REID: On either side of the line, you mean?

Mr. HENRY: On either side of the line.

Hon. Mr. REID: It does not affect your answer?

Mr. HENRY: It does not affect it at all.

Hon. Mr. REID: There would be the same results?

Mr. HENRY: If I am informed correctly—and I am not speaking now from having made a personal investigation of the costs—if I am informed correctly it would not cost more than three and a half millions more to build an equivalent canal on the Canadian side.

Hon. Mr. REID: And to have the same results?

Mr. HENRY: To have the same results.

Hon. Mr. MURPHY: Mr. Henry, with regard to the whole problem, is there any difference between the report of the Joint Board of Engineers and the recommendation of the National Advisory Committee?

Mr. HENRY: Now, I have not examined the report in sufficient detail to be able to answer that question.

Hon. Mr. MURPHY: I see.

Mr. HENRY: It is a very voluminous report.

Hon. Mr. MURPHY: I know it is, and I think the questions here have sometimes confused the two, and therefore the answers that are elicited, in my judgment, do not bear exactly on the point that the Committee was under the impression they did bear on.

Mr. HENRY: Senator McDougald read the question I answered.

Hon. Mr. MURPHY: My remark has no reference to that at all.

Mr. HENRY: No reference to that question.

Hon. Mr. MURPHY: I am just asking you generally, but you say you have not examined the two reports sufficiently to be able to say if there is any difference, and, if so, what is the extent of that difference.

Mr. HENRY: I am only dealing, Senator, with the broad question.

Hon. Mr. MURPHY: Yes.

Mr. HENRY: There are a lot of details involved, and differences of opinion, regarding costs and things of that kind, that I would not like to discuss at all.

Hon. Mr. MURPHY: I am only asking as to the project as a whole, without going into the details, but possibly you could not discuss it without going into some of them.

Mr. HENRY: No, you would have to go into the details. I am assuming that the project is feasible from an engineering point of view, and that the costs as recorded in the report are within reason. Of course I know enough about construction work to know that variations here and there may be necessary as work develops.

Hon. Mr. MURPHY: What you have been saying to the Committee is not to be interpreted as preferring one project to the other?

Mr. HENRY: No.

Hon. Mr. POPE: You believe it is essential for the future development of Canada that waterways should go through?

Mr. HENRY: Yes.

Hon. Mr. McDUGALD: Just to clear up a point that was not cleared up this morning to my satisfaction, I want to ask this: the Soulanges canal has a capacity now of 14,000,000 tons; the Cornwall canal and the Morrisburg canal are the weak links; supposing that money was spent to bring the Cornwall and Morrisburg canals up to the capacity of the Soulanges canal, in your opinion how long after that would we reach the peak capacity, at the present rate of traffic?

Mr. HENRY: I should think about 1938 would be a reasonable date.

Hon. Mr. McLENNAN: I want to shift your mind to another subject, about coal; could the deep waterway have any material effect on the access of American coal to Montreal?

Mr. HENRY: Well, a large volume of American coal every year finds its way to Lake Erie ports. It is produced principally in the states of Pennsylvania and Ohio. The rail rate on that coal to barge vessels at Lake Erie ports is approximately \$1.75 a ton; that is the rail rate. At present the coal can be mined at a cost of from \$1.50 to \$2, depending upon the location. The prevailing rate at the moment is \$1.35 to \$1.50.

Hon. Mr. McLENNAN: That is the price at the mines?

Mr. HENRY: That is the price at the mines.

Hon. Mr. McLENNAN: Sometimes it is not the cost.

Mr. HENRY: No, it is not at cost in terms of cost; a good many mines at the present moment are working on the basis of what we call out-of-pocket cost; they are not getting interest on their investment. There is over-production. Probably \$1.75 would be a fair price, so if you add \$1.70 to that, you have \$3.45 at the lake ports. I don't recall what the rate would be from there down to Montreal, but without having the figures before me I would venture that it would not be more than 60 cents a ton.

Hon. Mr. McDUGALD: I think they could carry it for 60 cents a ton, but I think the going rate is 80 cents.

Mr. HENRY: Then when we take 80 cents you have \$4.25. I think the boat rate of coal from Sydney to Montreal is something like 60 cents also, is it not?

Hon. Mr. McDUGALD: Yes.

Mr. HENRY: So that the mine price is in the vicinity of \$5. So that you have \$4.25 coal—of course there are no handling charges in Montreal at those prices—against \$5.60, soft coal. Does that answer your question?

Right Hon. Mr. GRAHAM: What is that \$4.25?

Mr. HENRY: That is the price at which American coal from Ohio and Pennsylvania could be landed by boats at Montreal.

Right Hon. Mr. GRAHAM: Then there would be 50 cents duty to add to that?

Mr. HENRY: 53 cents duty.

Hon. Mr. McDUGALD: I might say that they are laying down Scotch bituminous coal at Montreal at \$4 a ton.

Hon. Mr. McLENNAN: Those answers as to price have rather disposed of my other questions as to the possibility of transshipping at Montreal, Sydney coal, and taking it further west.

Mr. HENRY: It would be rather difficult, I am afraid.

Hon. Mr. McLENNAN: There was a time when Sydney coal went much further into Canada than it is doing now.

Mr. HENRY: Yes, I understand so.

Hon. Mr. McLENNAN: There were several years, a long time ago, when we used to send it to Belleville.

Mr. HENRY: Of course the National Railways use the eastern coal to Belleville.

Hon. Mr. McDUGALD: That is rail from Montreal.

Right Hon. Mr. GRAHAM: In Brockville we tried Nova Scotia coal for two or three years in our Utility Commission, but under conditions we could get American coal considerably cheaper than Nova Scotia coal. Brockville is 125 miles west of Montreal. I suppose that in the record we ought to speak of Williamsburg canal instead of Morrisburg. Outside persons studying our data would not know what Morrisburg meant, probably.

Hon. Mr. BEAUBIEN: Would you care to give me your opinion on the suggestion made by Mr. Payne in a letter stating that transportation by water—which of course is mostly transportation for grain—is rather seasonal, and requires rapid transportation even more than cheaper rates, and that if railway facilities were specially given to the transportation of grain from the head of lake Ontario, for instance, from Kingston to Montreal, allowing all the boats that carry that from the head of the lakes to Kingston to go immediately back for another trip, it would serve to better advantage for the shipper, who would get quicker and just as cheap transportation to Montreal; if you cared to give your judgment on that, nobody would give a better judgment than yourself, I think.

Mr. HENRY: The rate which the railway would have to charge for that service would be greater than the corresponding movement would cost if it were handled by boat.

Hon. Mr. BEAUBIEN: But the outlay of capital in one case could not be compared with the other.

Mr. HENRY: Oh, the railways would have very little capital expenditure.

Hon. Mr. BEAUBIEN: When you say that the transportation in that case would be cheaper by water than by rail, do you take into consideration the outlay of capital required in the one case, and not in the other?

Mr. HENRY: In no case have I considered the outlay of capital. I have been dealing entirely with rates.

Hon. Mr. BEAUBIEN: Then you disregard entirely the huge amount of capital which would be spent for the development of the waterways, in answering my specific question?

Mr. HENRY: In answering your specific question, if you were to charge the whole capital—of course interest upon the whole capital—against the movement of grain it would be more expensive. That could only be done, I suppose, by charging toll.

Hon. Mr. McLENNAN: On the other hand, would it pay Canada at that rate to look at it as a saving of three cents a ton to the shipping port, and expend so many million dollars?

Right Hon. Mr. GRAHAM: As against that should we not bear in mind the fact that all this capital expenditure that will develop navigation, will also produce power that will give a revenue to meet that capital expenditure.

Mr. HENRY: I was going to make another observation also in addition to that. The fact that this waterway does control rates is of very great advantage to the whole Dominion of Canada, and especially so to the western farmer who, as I have said, is labouring under an economic disadvantage. Now, that capital cost measured on that basis, I think, would certainly be justified.

Hon. Mr. BEAUBIEN: I understand from those who have discussed this matter, mostly the newspapers, as far as a layman can understand the question, that the return freight is mostly package freight; is that right?

Mr. HENRY: At the present time there is quite a substantial quantity of package freight, yes. I think perhaps I could give you the movement. The up-bound, in 1925—this is the St. Lawrence canal I am talking about—amounted to 1,358,000 tons, and it was about as follows: wheat, 6,000 tons; other grains 8,000 tons.

Right Hon. Mr. GRAHAM: Going west?

Mr. HENRY: Going west. That might have been Argentine or some other corn, you see. Agricultural products 4,400 tons; animal products, 2,159; pulp wood—there is a lot of pulp going up—653,000 tons; other forest products 18,000; products of mines—hard coal, 4,240; soft coal 91,000; ore 43,000; other mining products, 123,000. Now, the manufactures, in which would be included package freight, amounted to 402,000 tons.

Hon. Mr. BEAUBIEN: That is slow freight?

Mr. HENRY: That might be wire and hemp and things of that kind, agricultural implements.

Hon. Mr. BEAUBIEN: After the development is completed, where do you see in that development itself any call for an increase of that package freight? That is slow freight, all right?

Mr. HENRY: Yes, it is slow freight. Of course I think the larger movement coming down to Montreal would increase the movement west bound, and take from the railways—this would work to the disadvantage of the railway temporarily—a larger volume of freight than is now going up, all kinds.

Hon. Mr. BEAUBIEN: I cannot very well connect the answer with the question.

Mr. HENRY: What I mean is that there is a large import tonnage finding its way into Montreal, from which point it is distributed throughout Canada.

Hon. Mr. BEAUBIEN: That exists now?

Mr. HENRY: Yes; part of this 400,000 tons consists of imports. I imagine a good deal of it is produced in Montreal and goes west from there, but there

is a large volume of tonnage, a substantial volume of tonnage, entering into Montreal now, destined for points in the west. I think that when this canal is developed a larger proportion of that will move west by water than moves now; and the reason will be that the cost will be very much less. The delay will not be so important as the relative cost. You see, it does not move up to the same extent as it would because of the fact that there are not so many of those canal boats that go clear up to the head of the lakes. That is the chief reason—not many of them; there are some; but they stop at Port Colborne, and therefore the tonnage that we are talking about here is probably tonnage that is for Ontario destination. Now, with the larger boats, and going from Montreal straight through to the head of the lakes, I am reasonably sure that there would be an increased tonnage.

Hon. Mr. McLENNAN: That cargo has to go through the one port to be profitable; the bigger boats could not answer?

Mr. HENRY: The bigger boats might stop at Toronto and unload some, and then Hamilton, and go through.

Hon. Mr. McLENNAN: They do not like it much.

Mr. HENRY: They do not like it. Of course you are not talking there about the very, very large boats; you are talking of the medium sized boats.

Hon. Mr. BEAUBIEN: To understand the question perfectly, do I understand that the boats, being smaller, go from Montreal to the Welland canal, and then there tranship? I am talking of package freight.

Mr. HENRY: I do not believe there is any transshipment at all at Port Colborne. There are no facilities there that I know of to do it.

Right Hon. Mr. GRAHAM: Is there anything in this? I admit we are developing the trade now not for the benefit of the railways—but we develop a trade between Pacific ports and Montreal in lumber, say between British Columbia and Eastern Canada, through the Government Merchant Marine, with greater facilities for distributing this product after it lands in Montreal, or even if it were transhipped at Montreal; would there not be traffic from east to west in that matter to Ontario points, to be distributed?

Mr. HENRY: Yes, I think that is true, and I have some figures here that might be illuminating. The present rate charged by the Canadian Government Merchant Marine on lumber from Vancouver to Montreal is \$15 per thousand. I think the rail rate is between \$27 and \$35, somewhere in that neighbourhood.

Hon. Mr. McDUGALD: That is about correct.

Mr. HENRY: I think it would be quite possible to distribute that lumber almost throughout Ontario. I do know that a lumber company is handling lumber from the Pacific coast via the Panama canal and is transshipping it at Providence and Poughkeepsie and that it goes inland by rail as far as Buffalo in the United States, and I see no reason why it could not come up the canals and be distributed generally through Ontario.

Right Hon. Mr. GRAHAM: That would, to a large extent, keep in Canadian bottoms whatever advantage there was in trading between the Pacific and eastern Canada in Canadian-made products?

Mr. HENRY: Yes, I think it would to a large extent.

Right Hon. Mr. GRAHAM: You remember that we put on a couple of boats to try and open up the Pacific trade between the east and the west via the Panama canal; I don't know how many are on now.

Mr. HENRY: Yes; I have forgotten how many boats we have, but they are still operating.

Right Hon. Mr. GRAHAM: Those boats might possibly go right up the St. Lawrence route for the development of their cargo?

Mr. HENRY: They might go up a piece. That is within the realm of possibility.

Hon. Mr. McDUGALD: There is another movement; a lot of cargo coming to Philadelphia and Baltimore for western points beyond there in the United States; is there not a possibility that we might get a lot of that business coming through Montreal, and transhipped further on? I have in mind that Swedish wood pulp that comes in there at the present time.

Mr. HENRY: I think that is true. A good deal of the coastwise business which is now transhipped for western points such as Chicago, through the ports of Baltimore and Philadelphia, I could think move through the canal to Chicago and such points.

Hon. Mr. McDUGALD: I do not know whether you know it or not, but we will handle nearly 100,000 tons of Swedish wood pulp this year that is presently coming in through Baltimore and Philadelphia. That is for the western United States. And in addition to that we have negotiations under way for a million tons of another commodity. We may not get that, but we will get a portion of it anyway.

Mr. HENRY: I have a statement amongst my papers indicating the distribution of the tonnage through the Panama Canal in 1926. The total tonnage, the cargo tonnage, was 26,037,000 tons. It is divided: United States inter-coastal, Atlantic to Pacific, 2,435,000; Pacific to Atlantic, 7,633,000. That indicates the coastwise trade. (*See Table No. 5, page 245.*)

Right Hon. Mr. GRAHAM: There is this condition—perhaps it does not exist now—that quite a percentage of our imports come via New York and Buffalo for Western Ontario, and the United States gets the rail haul to Buffalo, and our own railways get the very short haul from Buffalo. Of course since we changed the preferential in order to induce traffic to come to our own ports that has been improved somewhat. What effect would the St. Lawrence canals have on that traffic that now comes via New York and by rail to Buffalo?

Mr. HENRY: During the season of navigation I think it would be diverted, or a portion of it at any rate. The reason that that traffic moves through New York now is because of the regularity of the liner movement from Europe. A good deal of it is express, and that is on a time delivery basis.

Right Hon. Mr. GRAHAM: And they can get it whenever they want it.

Mr. HENRY: They can get it whenever they want it. That is a reason too. As the liner development during the season of navigation increases to Montreal, it will be possible to increase that business.

Right Hon. Mr. GRAHAM: If we had a development—estimated, of course—an inducement for traffic to come to Montreal and Quebec by way of the cheaper river transportation, when it was slow freight, don't you think there would come somewhat of a compensation to the Canadian Railways in the express that would come in addition?

Mr. HENRY: I think so. I am inclined to think that any disadvantages which result temporarily to the railways will be offset by corresponding advantages on the other side. As an outstanding illustration of that I will cite the motor industry. It is true that there has been no increase in the passenger business on the railways for a number of years, but it is also a fact that the freight development which has resulted from the manufacture of automobiles has been of very great benefit to the railways.

Hon. Mr. SMITH: Have you ever given study to the probable proportions of upbound traffic going to the United States, and downbound traffic? What proportion of the total traffic in the canal, if it is built, might be of benefit to Canada, and what proportion to the United States?

Mr. HENRY: Well, I have not any figures in mind at the moment, except general figures. I do not know that I would be justified in quoting them, Senator. My opinion is that there would be a larger volume of United States traffic—I am leaving grain out now—commodities other than grain—when the deeper canal is put in operation.

Hon. Mr. SMITH: Would it not be possible that a lot of package freight and bulk freight would come up to Chicago?

Mr. HENRY: Unquestionably. One of the economic disadvantages which the central United States is suffering under now is the congestion, the necessary cost of providing extensive railway facilities between Chicago and the East. It is becoming increasingly difficult; so difficult that some of the marginal commodities find it rather difficult to move that way. I think those commodities will go out by the canal.

Right Hon. Mr. GRAHAM: Is it not a fact, heterodox as it may seem, that the more your traffic increases by water the more it increases by rail?

Mr. HENRY: Oh, unquestionably. The reason is this. The whole social structure of modern industry is based upon cheap transportation. There are some commodities that have an intrinsic value in the world's markets which will permit them to pay a high rate, and there are others whose intrinsic value will not. If the transportation rate is so high that they cannot move, a large amount of that traffic is not present, and nobody gets it. But if cheaper transportation facilities are provided, it begins to move, and it carries in its train a lot of traffic of other kinds, because these industries employ people, and these people require transportation, and that transportation is relatively of a high character, and so the thing goes on.

Right Hon. Mr. GRAHAM: Traffic gets in the habit, if I may use the term, of going in a certain direction?

Mr. HENRY: Yes.

Right Hon. Mr. GRAHAM: The cheaper traffic will go one way, and the high-grade traffic will go by rail?

Mr. HENRY: Yes. The traffic which depends upon expedition, and the value of which is such that the cost of transportation does not figure very much, will go by rail. The traffic whose value is relatively so low that the cost of transportation is a substantial factor will go by the route that gives the lowest transportation costs.

Hon. Mr. McLENNAN: Has there been much improvement in the despatch of goods by rail of recent years?

Mr. HENRY: Unquestionably.

Hon. Mr. McLENNAN: It is approximating to the English or European condition, is it? It is a matter of hours? Someone spoke of Eaton's goods coming out of the ship and being in Toronto in 24 hours.

Mr. HENRY: Oh, that is quite possible. If the shippers will co-operate with the railways and tell them a sufficient time in advance what the requirements are, so the railways can provide for it, a very expeditious service can be provided, and is provided. We give a daily service between Montreal and Toronto, and vice versa.

Hon. Mr. McLENNAN: On your ordinary tariff? Not express?

Mr. HENRY: Both express and ordinary L.C.L.

Hon. Mr. McLENNAN: Because in the old days, thirty years or more ago, there was not a very substantial difference in the time between water and rail.

Mr. HENRY: No, there was not.

Hon. Mr. McLENNAN: There was a great deal of delay on the railways. A car might go here and there and take three times as long as a barge would take.

Mr. HENRY: That is all changed. The railways are now co-operating with the various interests, and they run what we call fast freight or manifest services. Those services must keep to schedule. They can only be run, of course, when the volume of business will permit running a train.

Hon. Mr. McLENNAN: There is no shunting out on those trains?

Mr. HENRY: Occasionally.

Right Hon. Mr. GRAHAM: That is due to competition?

Mr. HENRY: It is due to co-operation between the shipper on the one hand and the railway on the other.

Right Hon. Mr. GRAHAM: In the early days when I happened to be Minister of Railways the complaint was that people were looking for cars. Now the cars are looking for the people. The railway companies are alive to the situation and are keeping track of all the traffic, and you do not have to wait a couple of weeks for a car; they are there offering you a car.

Mr. HENRY: Absolutely.

Hon. Mr. McLENNAN: Have you considered the possibilities in relation to the choking of our water transportation by the development of the business, and what effect Russia coming in again will have?

Mr. HENRY: I have considered that. I do not look for much competition for eight or ten years, but following that there will be rather severe competition, I think. But there is just this feature that may help us out; by that time the Russian peasant may have learned to eat more wheat than he did previously, and if he does that he may not have as much to export.

Hon. Mr. McLENNAN: I had the impression with regard to the relative cost of rail and water, that water was about 25 per cent of rail.

Mr. HENRY: Well, it varies a good deal, Senator, for the reason that the chief costs in railway operation have to do with overcoming resistance due to rise and fall. Where you have countries with heavy grades the costs are relatively much higher than where the grades are light. But generally speaking, probably from 20 to 25 per cent would be a reasonable comparison. When I say that, do not misunderstand me. That relates to the purely transportation end; that does not relate to the terminals, but to the movement.

Hon. Mr. McLENNAN: The terminals increase the rate very much, don't they?

Mr. HENRY: Oh, yes, very much.

The Committee then adjourned to the call of the Chairman.

TABLE No. 1—FORT WILLIAM-MONTREAL—TABLE OF EQUIVALENT DISTANCES AND SAILING TIME.

Port:		Present situation						Complete canalization to Montreal						Reduction due to new canal	
		Distance—Actual miles			Locks: Number	Equivalent distances	Sailing time hours:	Distance—Actual Miles		Locks: Number	Equivalent distances	Sailing time hours:			
From	To	Re-stricted	Un-re-stricted	Total				Re-stricted	Un-re-stricted				Total	Re-stricted	Un-re-stricted	Total
Port Arthur.....	Port Colborne.....	145	704	849	1	900	90	145	704	849	1	900	90	.....	.....
Welland Canal.....	Port Arthur.....	27	27	27	25	210	21	25	25	25	7	110	11	100	100
Port Dalhousie.....	Montreal.....	46	294	340	20	560	56	33	307	340	7	430	43	130	13
Total.....	.....	218	998	1,216	46	1,670	167	203	1,011	1,214	15	1,440	144	230	23

Analysis of rates on a ton mile basis indicates that after due allowance for terminal charges, insurance on cargo, etc., the charge per ton mile run, reducing distances to equivalent miles is .08c. for large upper lakes and .16c. for canal sized boats, or practically double. The saving would be one transfer at about .7c. per bushel, and:—

Present Equivalent Distance:

Port Arthur—Port Colborne..... 900 miles at .08c. =
 Port Colborne—Montreal..... 770 miles at .16c. =

cents
 72.00 per ton
 123.20 per ton
 195.20 per ton

This is 5.85c. per bushel

New Welland and enlarged St. Lawrence Canals:

This is 3.45c. per bushel

Saving is therefore 2.4c. per bushel inclusive of one transfer.

Port Arthur—Montreal..... 1,440 miles at .08c. =
 Total reduction is 3.0c. per bushel.

This reduces running cost 40%.

TABLE No. 2.—RATES ON GRAIN FROM HEAD OF LAKES TO PORT COLBORNE AND FROM PORT COLBORNE TO MONTREAL

(Cents per Bushel)

	Average Rates					Total 5 years	Average of 5 years
	1922	1923	1924	1925	1926		
Head of Lakes to Port Colborne.....	3.81	4.24	3.46	2.92	3.04	17.47	3.494
Port Colborne to Montreal.....	6.41	6.07	5.55	6.04	6.18	30.28	6.056

DIVISION OF RATES

	Total rate	Shovelling and elevation	Hull insur- ance	Total absorp- tion	Balance	Terminal time factor	Terminal time	Running time
	cts. per bush	cts. per bush.	cts. per bush.	cts. per bush.				cts. per bush.
Head of Lakes to Port Colborne.....	3.5	0.435	0.265	0.7	2.8	0.23	0.65	2.15
Port Colborne to Mont- real.....	6.1	0.825	0.615	1.440	4.66	0.205	0.96	3.70

2.15 cents per bushel=0.08 cents per ton mile.

3.70 cents per bushel=0.16 cents per ton mile.

TABLE No. 3.—SUMMARY OF VALUE OF MANUFACTURES IN FOLLOWING STATES

State	Year	Expressed in Thousands				Primary horse- power	Population in 1,000's
		Wages	Cost of materials	Value of products	Value added by manufacture		
		\$	\$	\$	\$		
New York.....	1900	337,324	1,018,377	1,871,831	753,454	1,099,931	7,269
	1910	557,231	1,856,904	3,369,490	1,512,586	1,997,662	9,114
	1920	1,458,207	4,943,214	8,867,005	3,923,791	2,926,963	10,457
	1925	1,533,893	4,704,989	8,968,548	4,263,559	3,348,184	11,162
New Jersey.....	1900	95,165	334,726	553,006	218,280	322,503	1,884
	1910	169,710	720,034	1,145,529	425,495	612,293	2,537
	1920	600,658	2,270,473	3,672,065	1,401,592	1,140,554	3,187
	1925	576,236	2,086,855	3,539,181	1,452,326	1,384,234	3,600
Pennsylvania.....	1900	296,876	958,301	1,649,882	691,581	1,716,694	6,502
	1910	455,627	1,582,560	2,626,742	1,044,182	2,921,547	7,065
	1920	1,406,066	4,210,409	7,315,703	3,105,294	4,445,095	8,773
	1925	1,324,481	3,890,514	6,901,762	3,011,248	5,373,972	9,476
Ohio.....	1900	136,428	409,303	748,671	339,368	783,665	4,158
	1910	245,450	824,202	1,437,936	613,734	1,583,155	4,767
	1920	944,652	2,911,948	5,100,309	2,188,361	2,885,007	5,809
	1925	975,812	3,029,686	5,347,523	2,317,837	3,482,618	6,471
Indiana.....	1900	59,280	195,163	337,072	141,909	325,919	2,516
	1910	95,510	334,375	579,075	244,700	633,377	2,701
	1920	317,043	1,174,951	1,898,753	723,803	1,094,568	2,942
	1925	365,003	1,257,961	2,125,023	867,062	1,420,989	3,095
Illinois.....	1900	159,104	681,450	1,120,868	439,418	559,347	4,822
	1910	273,319	1,160,927	1,919,277	758,350	1,013,071	5,639
	1920	801,087	3,488,270	5,425,245	1,936,974	1,654,947	6,528
	1925	897,971	2,926,064	5,321,838	2,395,774	2,247,408	7,093
Michigan.....	1900	62,532	175,966	319,692	143,726	368,497	2,421
	1910	118,968	368,612	685,109	316,497	598,288	2,810
	1920	639,708	1,919,243	3,466,188	1,546,946	1,193,709	3,711
	1925	792,225	2,466,426	4,373,186	1,906,760	1,887,750	4,284
Total.....	1900	1,146,709	3,773,286	6,601,022	2,727,736	5,176,556	29,572
	1910	1,915,815	6,847,614	11,763,158	4,915,544	9,359,393	34,633
	1920	6,167,421	20,918,508	35,745,268	14,826,761	15,340,843	41,407
	1925	6,465,621	20,362,495	36,577,061	16,214,566	19,145,155	45,181

TABLE No. 4—MANUFACTURES PRIME MOVERS, MOTORS AND GENERATORS BY NUMBERS AND RATED CAPACITY

Division and industry	Total primary horse power	Prime movers					
		Steam engines and turbines		Internal-combustion engines:		Water wheels and water turbines*	
		Number	Horse-power	Number	Horse-power	Number	Horse-power
United States: 1925.....	35,772,628	82,176	16,916,856	14,362	1,186,116	8,393	1,800,828
1923.....	33,056,870	90,019	16,697,573	15,696	1,233,297	9,289	1,803,220
1919.....	29,297,963	122,455	17,031,615	3,0437	1,220,808	13,976	1,765,031
GEOGRAPHICAL DIVISION, 1925							
New England.....	4,349,191	6,811	1,800,267	694	38,866	3,222	777,472
Middle Atlantic.....	10,106,390	20,440	5,035,646	3,553	347,197	2,174	325,962
East North Central.....	10,047,780	18,918	4,762,945	3,083	395,788	1,350	245,364
West North Central.....	1,855,278	5,369	792,581	1,271	81,520	288	65,525
South Atlantic.....	3,494,150	11,106	1,467,268	2,121	150,250	887	282,285
East South Central.....	1,615,183	6,434	1,615,346	1,250	31,159	145	16,934
West South Central.....	1,316,933	6,018	856,559	1,276	93,453	31	2,837
Mountain.....	757,974	1,853	396,529	296	12,444	89	6,274
Pacific.....	2,269,739	5,327	891,715	818	35,439	247	68,175
INDUSTRY GROUP, 1925							
Food and kindred products.....	3,881,952	16,677	1,680,331	4,661	177,417	2,126	109,392
Textiles and their products.....	3,986,136	5,001	1,857,195	336	19,068	2,054	460,951
Iron, steel and products excluding machinery.....	7,518,999	7,341	4,464,483	754	599,456	211	19,050
Lumber and allied products.....	3,472,750	21,705	2,493,600	2,652	57,959	749	48,448
Leather and its manufactures.....	413,779	1,218	212,103	82	4,434	79	4,955
Rubber products.....	656,857	453	298,631	14	294	25	3,241
Paper, printing and rel. ind. s.....	3,060,794	3,783	1,095,031	721	12,020	2,255	934,372
Chemicals and allied products.....	2,984,913	12,863	1,629,924	1,036	79,468	117	134,596
Stone, clay and glass products.....	2,348,157	4,249	937,914	1,753	111,836	163	29,096
Metals and prod. exc. iron and st.....	1,158,486	1,110	431,200	240	20,947	71	7,299
Tobacco manufactures.....	42,075	154	25,138	11	73	6	207
Machy. not inc. transp. equip.....	2,714,377	2,539	733,192	1,088	63,762	395	22,166
Musical instr. and phonographs.....	97,318	198	57,689	19	748	4	220
Transp. equip.-air, land, water.....	1,888,961	1,434	580,693	354	16,766	31	1,487
Railroad repair shops.....	942,248	2,062	352,604	147	4,823	32	36,495
Miscellaneous industries.....	604,826	1,389	157,055	484	17,045	104	69,035
							425,410

*Data for a small number of water motors included for 1919 but not for 1923 or 1925.

TABLE No. 5.—TONNAGE THROUGH PANAMA CANAL

Trade Routes	Tons of Cargo			
	1923	1924	1925	1926
United States Intercoastal—				
Atlantic to Pacific.....	2,608,307	2,719,240	2,213,603	2,435,748
Pacific to Atlantic.....	5,460,246	10,808,138	7,282,656	7,633,856
Total.....	8,068,553	13,527,378	9,496,259	10,069,604
East Coast United States—West Coast South America				
Atlantic to Pacific.....	275,313	373,348	377,864	423,730
Pacific to Atlantic.....	1,779,210	2,329,281	2,661,756	2,816,346
Total.....	2,054,523	2,702,629	3,039,620	3,240,076
Europe—West Coast South America—				
Atlantic to Pacific.....	486,952	627,356	776,388	783,007
Pacific to Atlantic.....	1,263,034	1,378,501	1,708,626	1,612,733
Total.....	1,749,986	2,005,857	2,485,014	2,395,740
Europe—West Coast Canada—				
Atlantic to Pacific.....	230,331	242,279	361,792	377,446
Pacific to Atlantic.....	885,670	1,211,535	1,409,277	1,681,663
Total.....	1,116,001	1,453,814	1,771,069	2,059,109
United States—Far East—				
Atlantic to Pacific.....	1,466,013	1,504,275	1,234,608	1,421,214
Pacific to Atlantic.....	443,272	294,003	266,269	333,834
Total.....	1,909,285	1,798,278	1,500,877	1,755,048
Europe—West Coast United States—				
Atlantic to Pacific.....	375,700	427,992	334,761	324,540
Pacific to Atlantic.....	1,020,090	1,231,230	1,157,556	1,331,662
Total.....	1,395,790	1,659,222	1,492,317	1,656,202
Europe—Australasia—				
Atlantic to Pacific.....	415,861	509,477	518,406	543,825
Pacific to Atlantic.....	306,404	304,370	420,356	556,871
Total.....	722,265	813,847	938,762	1,100,696
East Coast United States—West Coast Canada—				
Atlantic to Pacific.....	168,140	130,364	178,110	199,175
Pacific to Atlantic.....	347,407	356,223	501,623	651,969
Total.....	515,547	486,587	679,733	851,144
United States—Australasia—				
Atlantic to Pacific.....	462,057	587,481	663,619	727,406
Pacific to Atlantic.....	72,534	47,777	28,195	33,087
Total.....	534,591	635,258	691,814	760,493
Miscellaneous Routes and Sailings—				
Atlantic to Pacific.....	597,585	738,288	739,246	801,006
Pacific to Atlantic.....	903,749	1,173,552	1,124,125	1,348,330
Total.....	1,501,334	1,911,840	1,863,371	2,149,336
Total Traffic, All Routes—				
Atlantic to Pacific.....	7,086,259	7,860,100	7,398,397	8,037,097
Pacific to Atlantic.....	12,481,616	19,134,610	16,560,439	18,000,351
Total.....	19,567,875	26,994,710	23,958,836	26,037,448

MINUTES OF EVIDENCE

WEDNESDAY, 6th June, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, etc., met this day at 11 o'clock a.m.

The Honourable C. E. Tanner presiding.

Mr. JAMES PLAYFAIR, President and General Manager, Great Lakes Transportation Company, Limited, Midland, Ontario, appeared as a witness and testified, as follows:—

By the Chairman:

Q. Mr. Playfair, all witnesses begin by telling where they reside and what business they have been engaged in, so that the public may know that they are speaking with some authority.—A. I live at Midland, Ontario.

By Hon. Mr. Murphy:

Q. What is your full name?—A. James Playfair.

By the Chairman:

Q. You might tell us what business you have been engaged in, how long, and that kind of thing.—A. I have been in the transportation business mostly; well, for the last fifteen or twenty years.

Q. I suppose that transportation covers grain as well as other commodities?—A. Oh, yes.

By Hon. Mr. McLennan:

Q. You own steamers?—A. Oh, yes. We built up in Midland the biggest steamer in fresh water, a 15,000 tonner. Now, ask your questions and I shall be glad to answer them.

By the Chairman:

Q. Mr. Playfair, I will not ask you many questions. What we hope to get from you is some information dealing with this proposed deeper waterway. We have had very little evidence in respect to the existing transportation system from Montreal up.—A. Now, as you have got the Welland canal, I do not see anything to do but just get a good terminal down here around Prescott or some other place like that and let the larger boats come down there, and transfer there to the smaller boats for Montreal.

By Hon. Mr. Reid:

Q. The same as they do at Port Colborne?—A. The same as they do now at Port Colborne. But I do not think by doing that you will get the grain carried a bit cheaper than now.

By Hon. Mr. Murphy:

Q. Even after the Welland canal is completed?—A. Not a bit cheaper, because they are carrying it now all summer at a loss, and they cannot lose any more than they do now. The steamboats are not making any money to-day or in the last two or three years in the grain trade, they carry the stuff so cheaply, with the competition since the Wheat Pool came in. The Wheat Pool just dictate to us what they are going to give.

Q. Does that apply to other classes of freight too?—A. Not so much. There is a pulpwood trade. That is just a small trade, and there are just a certain number of boats for that trade, and they have been keeping them going pretty well, do you see. Supply and demand have kept that rate up. But even that has gone a little in the last year, on account of so many boats coming over from the Old Country.

By Hon. J. H. Ross:

Q. Do the grain boats carry nothing but grain?—A. Oh, yes, they take grain down and generally coal up.

By Hon. Mr. McLennan:

Q. That is American coal?—A. That is American coal to Fort William and other Lake Superior ports. And then the big bulk of the grain is carried by American boats.

By Hon. Mr. Murphy:

Q. Does the opinion you have expressed, Mr. Playfair, about there being no reduction in the rates even after the Welland canal is completed apply to the carriage of grain, we will say, from Port Colborne to Montreal?—A. Yes.

Q. You mean the rate between those two points would not be lower?—A. I mean the rate from Fort William to Montreal.

Q. Fort William to Montreal?—A. You see, in the summer-time the at-and-east rate is 8·60. In the spring of the year the boat fellows try to get about 10½ cents for the first trip. About 3 cents—about 2½ cents and 8·60 would be about 11 cents.

By Hon. Mr. Reid:

Q. That is to Montreal?—A. They try to get that for the first trip. Then the next trip they get down to 10 and 9, and so on, and last summer they were carrying stuff, I think, as low as 5 cents.

By Hon. Mr. McLennan:

Q. That was just to keep the boats going?—A. Yes, but they are losing money. You cannot get it any cheaper than that by having your terminal at Prescott.

By Hon. Mr. Reid:

Q. The rate is now 3 cents to Buffalo or Port Colborne.—A. It is not, but say that if you like.

Q. What is it? I mean, the average rate was 3·60, I think, during the season of 1927.—A. I bet you it was not 2 cents.

Q. Then we will take it at 2 cents. I mean 3 cents roughly. Now, from there to Montreal it was about 7 cents.—A. Oh, no, no; that is only on the opening of navigation and in the fall of the year, the last month. In the summer time it was down to 4 cents and 5 cents.

Q. From Port Colborne?—A. Yes, I can give you all those figures if you want them.

Q. I have a statement from the Bureau of Statistics here, giving the rates during the season. I am only trusting to memory, but I will look it up. The average rate was 3·60 between Port Arthur or Fort William and Port Colborne or Buffalo during the season, and from there to Montreal it was about 7.—A. No, you are away out.

Q. All right, then, I will look that up.

Hon. Mr. MURPHY: Mr. Playfair has suggested that if you so desired he would get a schedule of rates and send it on to you. Would you do that when you go back?

Mr. PLAYFAIR: Yes.

Hon. Mr. MURPHY: Thank you.

By the Chairman:

Q. For how much of the season would these rates prevail?—A. In the spring of the year. Since the Pool came into existence they will not book ahead at all, and all they do is hammer you down. If the boat fellows were strong enough they might get them to give a decent rate, but the boat fellows do not stick together. They started out this spring at $10\frac{1}{2}$ and there was no business offering, and then they made a cut to 10, and the next cut was to $9\frac{1}{2}$, and now, I think, it is down to about 8 cents, through to Montreal.

Hon. Mr. REID: That is all it is?

By Hon. Mr. McLennan:

Q. It will stay low until the new wheat comes?—A. It will stay low as long as the Pool controls that. In the fall of the year, when the big crop rush comes in, and the fellows start to move it, you can jack them up a little bit on your rate.

By the Chairman:

Q. You say it is the Pool that control the rates, not the steamship people?—A. The Pool, they are the boys. Call them the farmers. The farmers control the rates and they can give you what they like. For instance, there is over 60,000,000 bushels in Fort William now piling up, and over 15,000 cars loaded. There is an embargo on grain coming into Fort William and the boats cannot get a load. There is no demand for wheat.

By Hon. Mr. McLennan:

Q. They are holding it for the market.—A. Yes, but nobody will buy it. So it is not a case of rates at all.

By the Chairman:

Q. If I remember correctly the evidence of the engineers and also the evidence of the economists like Mr. Henry, they gave us very positive statements to the effect that the deeper waterways, by which steamers could come right down to Montreal, would inevitably reduce the rates several cents.—A. The Premier of Manitoba told the farmers, "If you get the deep waterway canal it would lower the rates 7 cents," and I wrote and told him I would take the contract to move all the grain for 7 cents. So how could he save 7 cents?

By Hon. Mr. Murphy:

Q. And you are in the business?—A. Yes.

Q. That is your business.—A. The rate from Fort William to Montreal does not average 7 cents the year through, I am pretty sure.

By the Chairman:

Q. Will you give us those rates?—A. Yes, I will give them to you.

Hon. Mr. REID: Here is the statement from the Statistical Branch. What would you have to say about this?

"Dominion Bureau of Statistics,
Internal Trade Branch."

Here are the questions I asked:—

"What was the rate by water, season of 1927, on wheat from Port Colborne to Montreal?—A. 5.53 cents per bushel.

"What is the distance in miles from Port Colborne to Montreal?—A. 374 miles.

"What quantity of Canadian wheat in 1927 went from Buffalo to New York, and during the season of 1927 for export?—A. Receipts of Canadian wheat at Buffalo, 119,676,656 bushels; export of Canadian wheat from New York, 61,618,298 bushel.

"What quantity of Canadian wheat in 1927 went by water route to Montreal for export?—A. Receipts of Canadian wheat, Montreal, by water, 69,598,154 bushels; export of Canadian wheat, Montreal, by water, 45,055,788 bushels.

"What was the rate on wheat from Port Arthur to Port Colborne, season 1927, and also to Buffalo from Port Arthur?—A. To Port Colborne 2.55 cents per bushel; to Buffalo, 2.79 cents per bushel."

MR. PLAYFAIR: That was a little over 7 cents.

Hon. MR. REID: That would be 2.55 plus 5.53, which would equal 8.08 cents.

MR. PLAYFAIR: I will bet that is wrong. But never mind——

Hon. MR. REID: The rate from Port Colborne to Montreal is 5.53, and to Port Colborne it is 2.55, which is lower than to Buffalo. The average was 8.08 cents.

MR. PLAYFAIR: The way they get those figures is that inquiries are sent out to the boat fellows and they often put a little higher than the real rate they are getting.

By Hon. Mr. Murphy:

Q. That is the way they get their statistics?—A. Yes. They send to every boat fellow and he is asked to mark down what he is getting, and I know lots of cases where they mark up the rates, you see, because they do not want to let on that the rate is cheaper. But I can get from the boat fellow just what he does charge.

By Hon. Mr. Reid:

Q. By own impression has always been that when you get the Welland Canal in operation they will bring that grain right through to Prescott for one cent more per bushel than they are getting to Port Colborne.—A. Now, supposing they do?

Q. That is 3.79 cents.—A. Yes.

Q. And 2 cents a bushel, I say, will take it to Montreal.—A. Two cents a bushel will not pay their cost—will not pay the cost of their labour. You can figure it up yourself. You have got to pay the elevator for handling your grain, and you have got to pay the Canadian National and the C.P.R. for loading it in Montreal. Well, that is over a cent. That is pretty near one and one-fifth.

Hon. MR. McLENNAN: It is nearly one and a half.

MR. PLAYFAIR: Yes.

Hon. MR. REID: No, no, one cent will do it.

MR. PLAYFAIR: No, it is more.

By Hon. Mr. McLennan:

Q. In and out?—A. In and out. They pay the elevator at Prescott three-quarters of a cent, and then they pay seven-tenths down in Montreal for unloading it.

By Hon. Mr. Reid:

Q. But what I am figuring on is that three-quarters of a cent takes it out of the lake boat, puts it into the elevator, takes it out of the elevator and puts it into the canal boat.—A. No, no. The boat fellow that goes to the elevator has got to pay for the unloading of his boat.

Q. Now, it does not cost three-quarters of a cent to put it into the barge?—
A. No, no, not into the barge. I think the charge at Port Colborne is one-half cent; \$5 a thousand bushels.

Q. To put it in?—A. Yes.

Q. That is, the boat that comes from Port Colborne to Montreal has to pay one-half cent?—A. Yes; he pays \$5 a thousand.

Hon. Mr. McLennan: That is one and a quarter cents, then.

By Hon. Mr. Reid:

Q. Then what do you think it would cost to make it to Montreal?—A. I think the railroad would get about—

Q. But the barges?—A. I don't think the barges will do it any less than three cents, if you get it for three cents.

Q. And do you think one cent more from Port Colborne would take it to Prescott?—A. In the summer time, the time at which the big boats are not busy.

Q. In the fall?—A. No, I don't think in the fall, because in the fall of the year you can't get them down there at all.

By Hon. Mr. McLennan:

Q. You mean the lower lake—Getting down to Prescott?—A. I mean in October and November, you can't get the big boats to go to Prescott at all.

Q. Why?—A. Because they have only got the one elevator there, for one thing.

Q. How would it be if you assume proper elevators?—A. When you can go to Buffalo—how many elevators have they in Buffalo?

By Hon. Mr. Reid:

Q. They have 30,000,000 capacity there?—A. They will go there when they can get despatch, and they will come to the Bay when they get despatch, and make two trips instead of one to Prescott.

By Hon. Mr. McLennan:

Q. I think you will have to assume proper terminal facilities at Prescott?—
A. Even so, they would not go down there for a cent more, from Lake Erie to Prescott, rather than to Buffalo. I would rather go to Buffalo for a cent less, for the time you are losing. Then the canal—the underwriters are going to charge these big boats more money to come through the Welland canal than they do when they don't canal. This year the underwriters will not take any risk at all with those canallers; all those canallers are running without insurance this year.

Q. Kicking at the rate?—A. The rate is so high. In other words, the fellows have been hit so hard; the rate through, I think, is 8 per cent, whether it is 6,000 deducted, and all they are insuring now is against total loss and collision done and sustained. The boat owners claim they cannot pay those rates. They have to pay those rates, and they are getting hard hit, and they have got to put it on the grain rate.

Q. That is the river boat, the 2,500 boat?—A. Yes.

Q. Would that not tend to increase with the larger boat?—A. They would raise the rate a little, going through the Welland canal. It used to be one-eighth excess for the lake trip and a quarter for Montreal. I think it used to be that if you made five full trips, if you got them for a cent the rest of the trips were free provided there was no loss on first five.

Q. Would there be more liability to accident with the lake boat coming through the Welland canal and through the river down to Prescott than with the present type of boat?—A. No, I don't think there would be much bother when you come to build the new Welland canal, because the locks are so big and you have so much more room to swing. Those little boats are just the

exact size, and if you give the engine a kick ahead she is into the gate. The new locks have about 40 feet in width to spare and you can check a boat up pretty quick. Of course, there is a couple of bad places around Prescott, that is, where the bends are, but it is not like this all through the river.

By Hon. Mr. Reid:

Q. They pass over light and then they cross over to the Canadian side?—
A. I think Prescott is the best place for your terminal. If you get them there it is all right.

By Hon. Mr. McLennan:

Q. There is another consideration; it has been stated to us that if the Canadian grain trade keeps developing as it has done the last six or eight years there are some points in the canal that will have to be improved if you are to have a 14-foot canal?—A. There are some places like Rapide Plat where it would need to be deepened so you could figure on 14 feet. I think sometimes in the summer it gets down to 13 feet, in the dry of the summer.

Q. It was stated that there were three places that there was a conscription, and that they would have to be improved, and then that, at the present rate of increase of trade, that would provide for about five years?—A. I think you should make some improvements there, as far as I know about it. There is a fall below in the canal now, you know.

Q. Of course that will always be?—A. The pulp wood is responsible for an awful lot of that. Look at the trade we are getting in pulp wood, that we never had a couple of years ago. The Thorold Company take 60,000 to 70,000 cords a year, and Ogdensburg a lot, besides Three Rivers, etc.

Q. What type of vessel handles that?—A. The grain fellow, after he takes grain down to Montreal, goes down to Matane and Anticosti and Seven Islands and up to Lake Erie and Thorold and Ogdensburg.

By Hon. Mr. Murphy:

Q. With the pulp wood?—A. With the pulp wood. That is really congesting the canals more than anything else.

By Hon. J. H. Ross:

Q. That will be carried on?—A. The pulp wood, yes.

By Hon. Mr. Reid:

Q. As a steamboat man, what is your opinion of this being an ocean-going route after the whole system is completed, the 25 or 30 feet of navigation through to Montreal? Will the ocean going vessels go there and take coal from Nova Scotia to Toronto or take merchandise from Liverpool or any foreign country to Port Arthur, and then bring down wheat right straight through from Port Arthur to Liverpool or any foreign country?—A. In the first place, I do not think you will get any ocean vessels to go up there without making a lot of changes, because ocean vessels have a small rudder to start with, and they have to make quick bends in the river, and this little rudder would not do it. You know that.

Q. But then they have a pilot.—A. Yes, the vessel takes on a pilot at different points, then the insurance company, I think, would charge them such excessive rates to go up there that it would not pay a boat to go.

By Hon. Mr. Murphy:

Q. What about the height of the boats?—A. That wouldn't make any difference; but you wouldn't get any through loads from the old country to the head of the lakes unless you took Scotch whisky, or something like that; that is the only commodity that will give you a through load, you would not

get a load of merchandise. Of course you can get some little package freighter to stop at Toronto and Hamilton and those other places, like our little package freighter, but they could not compete with those fellows out there, I think.

By Hon. Mr. McLennan:

Q. There would be as much package freight go up in the present canal boat as any other?—A. Yes; the Steamship Company run eight or ten full freight boats; they connect with the ocean steamer and take them right up to points like Hamilton, Sarnia, Courtright, and all those places.

Q. How far do they go up?—A. The head of the lakes, of course they get almost all their stuff of Canada manufacture. They just have some through export stuff from the old country, but that would never keep a boat going, what they get from there, and then the insurance people would want quite a bit for insurance to cover the lakes. Then you would have to get a new staff of men on the ocean boats, because those ocean fellows are not used to lake navigation; isn't that right?

By Hon. Mr. Reid:

Q. But you would only require a pilot?—A. You would want the men there.

Q. You only want one man there—a captain, if you like to call him that?—Well, you would have to have two different crews to come.

Q. Why?—The engineers and the men, the deck hands and the wheelmen are the same?—A. But they are not used to that kind of work. You never in your life saw a boat in the old country landing at a dock without having half a dozen tugs. But Senator Reid has seen them up in Fort William turning in their own length in the river.

Q. But with the amount of water up there, you could take the *Aquitania* and put her into one of those places if she had lots of room?—A. But there is no room in these ports for that size of steamer.

By Hon. Mr. McLennan:

Q. You say you would have to have local men?—A. Yes, and then you would have to deepen every river and harbour from here to Fort William on the lakes to get the ocean boats up. An ocean boat would not carry her load unless loaded down to her marks, say about 30 feet.

By Hon. Mr. Reid:

Q. Yes, those 8,000-ton ones are better than the 25,000?—A. Yes, but a lot of those fellows are bigger than that.

Q. But the question I asked you was about the 8,000- or 10,000-ton boats, which are about the average tramp ship, if you want to call it that, or freighter?—A. What would they draw? Thirty feet.

Q. Thirty-five feet; that means 27 feet of water; in fact those fellows would go right through and take a load of grain right through to Liverpool?—A. No, I don't think they would do it as cheap as we can bring it down here and transfer it to them, taking everything into account—extra insurance, extra men, and other extra expenses—because they take these tramps coming out here, the ocean steamers only make one or two trips a year, and the insurance for each trip would be very heavy. Even coming to Montreal, they charge more insurance than going to New York or other Atlantic ports, do they not?

Q. It is on account of the insurance on the St. Lawrence route itself, that is what I understand; they charge more on the insurance, and they used to charge a little more on the harbour, and that makes it a little bit more at Montreal.

By Hon. Mr. McLennan:

Q. Montreal is much behind New York?—A. Yes, quite a bit.

Q. It has more risks?

By Hon. Mr. Reid:

Q. It was on account of the insurance as the principal thing?—A. The worst of Canada is that we can't ship grain in the winter; that is where we are handicapped. All our grain, you might say, goes to Buffalo in winter, like what left Fort William last fall for Buffalo.

Q. Why is it that the rates from Buffalo to New York regulate the rates between Buffalo and Montreal?—A. Well, no, they don't. The rate from Buffalo to New York is, I think, 9.10 and the rate from the Bay to Montreal is 8.60, and the railroads work together, you know.

Q. I think the rate is pretty nearly generally the same?—A. Yes, the same as the passenger rate; they are all hit the same. The Buffalo is a little dearer than it is to Montreal.

Q. The New York fees are cheaper?—A. No, that is done for the insurance, to kind of equalize the insurance; then the reason very much stuff goes to Buffalo is because they can ship out by eight or nine different railroads; they can go to Portland, Boston, and Baltimore, and any place else. When you ship to our country in the winter, all you can do is to go to Portland and St. John, and you are done.

By Hon. Mr. McLennan:

Q. In those ports like New York you get cheaper tonnage?—A. Yes, you get cheaper ocean rates.

Hon. Mr. McLENNAN: Not only cheaper, but a greater range of ports. I was looking at the chart the other day, and I see them all over, right away up to Norway.

By Hon. Mr. Reid:

Q. Well, I have been under the impression that as we stand to-day, we have at Port Colborne a competing rate with the Erie canal that can regulate the rates; we have railways as well; and if we can get these large vessels coming down, even as far as Prescott, that that rate from Port Arthur to Montreal will be cheaper, even if they have to tranship there as they do at Port Colborne, because there is not the competition there that there is in Montreal?—A. But do you want everybody to go broke carrying your grain?

Q. None go broke?—A. You take the Canada Steamships, they are not making any money to-day. Take Patterson and all those fellows; they are not making any money. The boats are tied up at Fort William.

They have got to get something to make a shilling. If you want to help the farmers, why not give them what your interest would cost you if you built this waterway and canal?

Q. I should judge from your opinion that we should stop at Prescott and use the present canals?—A. That is what I would say, until the country gets big enough to look after itself. You have more business now than you can take care of. You give me the interest on your deep waterway canal and I will move all the grain from Fort William for nothing.

By the Chairman:

Q. Your view is that the deepened waterway would not give cheaper rates?—A. It is not worth the expense you are going to.

By Hon. Mr. McLennan:

Q. Am I right in having this idea, that the only possible cheapening of the rate would be any difference in cost there would be between Prescott and Montreal, as compared with the present type of vessels?—A. You can get stuff carried from Prescott to Montreal a little more cheaply than you would from Port Colborne to Montreal, yes.

Q. What I meant was that if you had a deep water canal that would carry your big lake boat down to Montreal, and if she would stop at Prescott, the only difference would be the difference between the cost of those two services. That is the only place where there could be any real saving.—A. Yes. Then, another thing, you will not get the big volume of grain this way, down to Prescott, at all, when the crop starts to move in the fall of the year, in November and December, you will not get any of those big boats down there at all.

By Hon. Mr. Murphy:

Q. Because of the lateness of the season?—A. Yes.

By Hon. Mr. McLennan:

Q. Because they prefer to go to Buffalo?—A. Yes.

Q. And the owner of the grain would prefer to have it at Buffalo?—A. Yes, because he can get all the different railroads to ship. Here they have only one or two railroads.

By Hon. Mr. Reid:

Q. You have four railroads.—A. Where?

Q. At Buffalo you can ship to New York. It is closer to New York from Prescott than it is from Buffalo.—A. That may be, but it will not be any cheaper. You will find the railroads will not make any cheaper rate. You can ship from Sarnia to Montreal to-day for the same rate as from Port McNicol and Midland. It must be 170 miles further haul, yet the railroad will give you the same rate. Now, the rate from Kingston to Portland is just the same rate as it is from Midland. So these fellows all make the at-and-east the same.

The CHAIRMAN: There are a good many things that enter into this question.

By Hon. Mr. McLennan:

Q. If the rates were lower on the St. Lawrence by Montreal, the New York people and those railroads would not lie idle; they would make a corresponding decrease.—A. They will cut their rate just the same. The railroads, instead of cutting in the summer to meet the all-water rate, figure that it is better to let their rate to stay as it is and get the good rates in the winter and the fall.

By Hon. Mr. Murphy:

Q. You will let us have that statement you promised?—A. About the freight rates? Yes, as soon as I get back.

Hon. Mr. MURPHY: That will be a part of the record, then, Mr. Chairman.

Mr. PLAYFAIR: If you gentlemen could stop our Canadian grain from going to Buffalo, it would help Canada a lot, but I do not see any way you can do it.

By Hon. Mr. McLennan:

Q. How can you do it?—A. By the coastal laws. You are breaking the coastal laws all the time, because big American boats can go up there and load with our Canadian grain and go to Buffalo and unload, and then that grain is loaded by an American boat at Buffalo and is brought down to Montreal. That is breaking the coastal laws.

Q. They are evading the law.—A. Yes, they are doing it all the time.

Q. Did not the Government give a license to them?

Hon. Mr. REID: No.

Mr. PLAYFAIR: No, no.

By Hon. Mr. McLennan:

Q. By Order in Council, not for them, but in order to get the grain out?—

A. No. What the Government has done since the war is that for the last trip they rescind the coastal laws and let the American boats go to any place in Canada, to take grain for storage.

Q. For storage over the winter?—A. For instance, Port McNicol or Goderich.

Hon. Mr. REID: That was not since the war; that has been done for fifteen years. I will tell you why.

Mr. PLAYFAIR: I do not know, Doctor. They used to go to Port Huron, but never into our ports.

Hon. Mr. REID: I thought it was all Georgian Bay ports.

Mr. PLAYFAIR: No.

Hon. Mr. REID: I know it has been done for a good many years. The reason was this. At the time there was only about one-half the storage at Fort William and Port Arthur, and then there was storage at the Bay ports.

Mr. PLAYFAIR: That is right.

Hon. Mr. REID: Of course the purpose was to try to get so much more grain out.

Mr. PLAYFAIR: For the railroads.

Hon. Mr. REID: And American boats were allowed to come in.

Hon. Mr. McLENNAN: It was to relieve the Western country.

Hon. Mr. REID: That is the reason why it was done. But that is not so much a question of the coasting laws. When the Treaty was made in 1909 there was no such thing in the minds, at all events, of our men here, as that it would be considered right to do what you have mentioned, but, you see, it is international law. There is no way of getting around that.

Mr. PLAYFAIR: Which? Surely you are breaking the costal laws.

Hon. Mr. REID: I do not think you are.

Mr. PLAYFAIR: I will give you another example. I cannot go to Chicago with a Canadian boat and load in Chicago and bring it to Midland, and ship out of Midland to New England.

Hon. Mr. REID: You cannot?

Mr. PLAYFAIR: No. None of the Canadian boats can.

Hon. Mr. McLENNAN: That is the way they interpret the law.

Mr. PLAYFAIR: I am breaking the coastal laws. Then we let the Yankees do what they will not let us do.

Hon. Mr. REID: That was all brought up by the Government of Sir John Thompson.

Mr. PLAYFAIR: The politicians will sidetrack it and you never get anything done.

Hon. Mr. REID: When Sir John Thompson was Prime Minister he put on a rate of toll. In order to get over the difficulty, what he did was to put a rate of toll on all Canadian grain passing through the Welland Canal for Montreal that was not in Canadian vessels.

Mr. PLAYFAIR: I do not think we need do that.

Hon. Mr. REID: That was a protection. They used to come to Ogdensburg instead of Buffalo.

Mr. PLAYFAIR: Yes.

Hon. Mr. REID: But what happened was this. It was many years ago and I am only trusting to memory, but I think we had collected about \$160,000 in tolls, but the Americans immediately raised a row about it and Sir John Thompson had to refund the money.

Mr. PLAYFAIR: That was for toll. That was all right. I do not think that has anything to do with what I am telling you.

Hon. Mr. REID: But he could not get over the difficulty about the breaking of the law, because you have a right to carry from a Canadian port to an American port.

Mr. PLAYFAIR: Who?

Hon. Mr. REID: The Americans have the right to bring their vessel over to Canada for a cargo of grain.

Mr. PLAYFAIR: The Americans, I say, have no right to load at Fort William and go to Buffalo——

Hon. Mr. REID: Yes.

Mr. PLAYFAIR: ——stop there, and take that same grain and put it into another American boat at Buffalo and bring it to Montreal.

Hon. Mr. REID: Yes, they have. You cannot get around that now.

Hon. Mr. McLENNAN: That is evading our coastal laws.

Hon. Mr. REID: But you cannot get around it.

Mr. PLAYFAIR: Of course you can. The Yankees soon put the harpoon in that sort of thing.

The CHAIRMAN: Mr. Playfair, gave us the other case.

Mr. PLAYFAIR: I gave you the opposite case. They do it to us. I cannot go to Chicago, load coal there and bring it to Midland and ship it out of Midland to New England; but an American boat can bring it to Midland from Chicago and unload, and we cannot stop it.

Hon. Mr. McLENNAN: That is the way they interpret their coastal laws.

Mr. PLAYFAIR: You bet they do.

Hon. Mr. McLENNAN: Strictly. And we do not interpret ours in that way.

Mr. PLAYFAIR: If you went to work and put up a terminal at Prescott and would make all the Canadian grain go there instead of going to Buffalo, you would be doing the finest thing ever done. Then you would keep your Canadian tonnage working and would do some good. The Americans have ore, 60,000,000 or 70,000,000 a year, and keep their boats busy. The minute those boats are without a load of ore, or the next day, they offer them for the loading of grain and carry it cheaply, even losing money. Our fellows have nothing to carry all summer but grain and a little bit of coal. We have no ore as the Americans have.

By Hon. Mr. McLennan:

Q. I suppose the Americans can get practically enough cargo all season?—A. You take the American boats: they are chartered up, I would say, 85 or 90 per cent of the time, carrying ore.

Q. Carrying return cargo?—A. Yes, on contract with the steel trust. We have nothing in summer to keep our boats busy. But if we could carry all our own grain to Prescott or Buffalo, then we could keep them all going.

By Hon. Mr. Murphy:

Q. So they have the advantage in that respect?—A. Yes, they have the advantage of a big bulk freight offering all the time.

By Hon. Mr. McLennan:

Q. That is an economic advantage which it is hard to offset.—A. We have not got our right to carry our own coal. The Yankees can come in and carry our coal. You see, the Canadian Pacific Railway or the Canadian National in the West take up a million and a half tons of coal to Fort William, and this can all be carried in American boats. We have got no cinch on it. They make a low rate on the cargo, because they have a load of ore back. We have got to take the low rate of 30 cents per ton, and if we do not get a load of grain we have got to come back light for another 30 cents. It is rather one-sided, the lake trade.

By Hon. Mr. Reid:

Q. The question has been raised in the Senate by Senator Casgrain?—A. I believe he made a speech against this thing.

Q. I am only saying he raised the question about Norwegian boats?—A. There is another thing.

Q. Tell me how we are going to get over that?—A. I don't see that you can get over that, because you are supposed to be free; but these fellows do not cut much ice.

Q. They take from Buffalo to Montreal?—A. Yes, but they do not take an awful lot; little bits of cargoes.

By Hon. Mr. McLennan:

Q. That is under the general coastal laws?—A. Yes, you can't stop that.

Q. They take it to Buffalo, and then from Buffalo, that is the same as the United States?—A. No, it was altogether different.

By Hon. Mr. Reid:

Q. I cannot see that.—A. Leave it to your Attorney-General.

Q. I will take it up with him?—A. We have had Francis King down here, and Enderby up here for years trying to get it stopped, and they just give me the laugh and "happy day, glad to have met you". I may tell you that I was the first to start carrying motors from Detroit *via* Windsor, to Chicago, and it was very profitable. We took them over to Windsor on the ferry and ran them on the *Glenlyon* with their own power and landed them in Chicago. We only made five trips when stopped by the United States Government claiming that we were breaking the coastal laws. I went down to Washington to investigate and was told I could take one more trip, but if more, would be stopped and fined.

By Hon. Mr. Reid:

Q. If we had a decision of that kind, such as was given to you, as interpreted by the United States, we could stop those other American vessels at once?—A. If you could you would be doing the best thing that ever happened.

Q. How are we going to get that official decision—because that is exactly what they are doing with us?—A. You get all that grain to Prescott and Port Colborne that you are not getting now.

Q. But you get a decision in Washington that you could not take it with one boat to a Canadian port and another boat to an American?—A. Yes.

Q. Can you get me an official decision of that kind?—A. I think I have got the ruling at home yet.

Q. What year, or about what time?—A. When the motors started to go—it was after the war.

By Hon. Mr. J. H. Ross:

Q. Suppose a boat went to Buffalo and put the wheat in the elevator, while another boat came and took it out, would you have to get a transfer?—A. That would be covered by a bill-of-lading. It would be either No. 1 or No. 2.

By Hon. Mr. McLennan:

Q. Do you know how continuous that voyage is? You could not say that the grain might not be legitimately sold, speaking of it as fresh grain, and then the party changed his mind between Buffalo and Montreal? What I was thinking was, that it would be an evasion of the coastal law if that grain was shipped out within a certain length of time?—A. Suppose a shipper gave a boat a charter to move a million bushels of wheat to Montreal via Buffalo. He takes it down to Buffalo on a through Bill of lading to Montreal, and he gets his boat there, loads it, and ships it back to another American canaller, and he slips it down to Montreal; there would be no trouble in identifying that through bill of lading; it goes on a through bill of lading.

Q. Would you recommend a Canadian doing anything about those last trips?—A. I don't think I would bother about that much, because the more we can get down to the last trip the better, but I don't like to see so much stuff going to Buffalo. Now, the Bay has not had any grain at all this year to speak of, I don't think Port McNicoll has had a boat, or Midland; there is no demand for grain. It shows that everything we have got in Fort William is going to Buffalo.

By Hon. J. H. Ross:

Q. Our Canadian wheat from the west was not very good?—A. But they are not through threshing yet. When they get through last year's crop I think they will find it bigger than any yet.

By Hon. Mr. Reid:

Q. You heard me read that statement from the Statistical Branch, showing that 119,000,000 bushels of Canadian grain went to Buffalo, and 69,000,000 to Montreal; supposing this waterway completed, so that they can go to Prescott, and then by barge to Montreal, do you think we will get a portion, and if so what quantity to go to Montreal on account of the cheaper rate?—A. I don't think you will get any more. The Buffalo rate will be lower there just the same.

Q. Then suppose we have a 25-foot waterway right through to Montreal, so that even if you transhipped you would take a very much larger quantity from Prescott down, than you do with the present canal, do you think we will then be able to draw a portion of that 119,000,000 from the New York route?—A. Well, I don't know that I could answer that. You say there is 119,000,000 goes to Buffalo now?

Q. That is what I just read in the statistical statement?—A. You think you could get some of that here?

Q. Yes, when we have our 25-foot canal, instead of 119,000,000 bushels of Canadian grain going via New York and 69,000,000 now going to Montreal, will we get a larger share of that which is going to Buffalo?—A. I don't think it will make any difference, because you have got to ship to Buffalo to get to those different ocean ports.

Q. Here is what it was, what quantity of Canadian wheat in 1927 went from Buffalo to New York during the season of 1927 for export; you say part of the grain goes to Buffalo for the United States?—A. Yes.

Q. Do you think we shall get a larger share of export wheat from Montreal than we do, when that canal is built?—A. No, I do not think it would make any difference.

Q. You do not think even the deep waterway, or lesser freight rates, would make any difference?—A. No. The lesser freight rates will not come into it at all, because Buffalo will meet you all the time.

Q. You mean they will lower the rates?—A. Yes.

By Hon. Mr. McLennan:

Q. They are not going to give up the business.—A. If you have a cheap freight rate here, Buffalo will give just the same.

By Hon. Mr. Reid:

Q. In other words, you mean, the United States will not allow their American ports to lose traffic which they have got now, even if they have to reduce their rates?—A. Yes, that is what I think, because you have got to have ports to ship all over the world.

Hon. Mr. REID: Then you go to the cheapest port.

By Hon. Mr. McLennan:

Q. There will be no cheap port during the winter, that is the trouble. We have no cheap port during the winter.—A. That is where we are handicapped.

Q. Have you any idea, Mr. Playfair, how much of that 61,000,000 belongs to Canadians—of that 61,000,000 that went out through New York?—A. Well, I suppose the big bulk of that belonged to the Pool. You might say there is nobody shipping anything now but the Pool. Richardson ships a little, and Smith-Murphy, but the Pool are the great big shippers.

Q. Of course the Americans own a good part of it, too?—A. The Pool sells it to them.

Q. For export?—A. Yes. You know, the Pool sell to James Brown and to Rosenbaum; deliver in Buffalo on what they call c.i.f. Buffalo, and they sell to those fellows.

By Hon. Mr. Reid:

Q. If the merchant marine as a body were able practically to compel our Canadian vessels into a combine and fixed the rates, the same as they do from Port Colborne down now, with a 25-foot waterway— A. You mean the Canadian Merchant Marine?

Q. Yes, I mean the Canadian Merchant Marine and the American Merchant Marine, or whatever body it is. They fix the rates practically the same from Port Arthur to New York as they do to Montreal now. You see, it is 8·60.—A. That is the railroads.

Q. Anyway the rate was roughly 8 cents a bushel.—A. It was 8·60 from Bay ports to Montreal.

Q. Then from Port Colborne?—A. Port Colborne the same way by the rail, yes.

Q. Then by water it was about 7 cents?—A. By water it went down to 4, 5 and 6—all kinds of rates.

Q. It averaged 7?—A. That is what that account says, but I don't believe it.

Q. Then my question would not be much good, except for this, that I wanted to find out if, when we got that 25-foot waterway, there would then be any possibility of the American marine or railways—I do not care what body it is—being able to say to our Canadian Merchant Marine, under the conditions as they are now: "The rate from Port Arthur to New York is so many cents a bushel, and you must charge the same or else we will fight you." And we, being the weaker, might have to submit.—A. We would have to be under the Railway Commission to do that. You would have to put the boats under the Railway Commission to do that.

Q. To get cheaper rates?—A. No, to get a uniform rate. You could not control lake tonnage otherwise.

Q. They cannot handle any very great proportion?—A. No, but one or two boats will spoil the rate.

SCHEDULE OF RATES FROM FORT WILLIAM TO MONTREAL, SEASON 1927

March and April..	9 $\frac{3}{4}$ cents
May..	8 $\frac{3}{4}$ "
June and July..	5 $\frac{8}{9}$ "
August..	8 $\frac{5}{8}$ "
September..	8 $\frac{1}{2}$ "
October..	10 $\frac{1}{4}$ "

It will be noticed that June and July are very low, and at this figure the boat owners lose money. There is very little grain to move at this time of the year, so they take whatever they can get, hoping things will take a turn, but as a rule they do not.

JAMES PLAYFAIR.

The Committee then adjourned until 8 o'clock in the evening.

WEDNESDAY, 6th June, 1928.

The Special Committee on the Development and Improvement of the St. Lawrence River, etc., met this day at 8 p.m.

The Honourable C. E. Tanner presiding.

Mr. D. W. McLACHLAN, Engineer-in-Charge St. Lawrence Waterways, Department of Railways and Canals, Ottawa, Ontario, was recalled and testified, as follows:—

Right Hon. Mr. GRAHAM: Mr. McLachlan, there has been an inquiry made by two or three people concerning the water flow in the vicinity of Corn-wall—Sheek Island, Barnhardt Island, and Bergen Lake, I suppose you call it. I think it has been stated here that a much greater volume of water is on the American side at that point. Now, suppose we had not erected the Sheek Island dam, or even our canals, what would the flow of water be as between the two countries in its natural state at that point?

Mr. McLACHLAN: I think it would be somewhat misleading to answer that question in just exactly that way. From the head of Barnhardt Island down to the foot of Barnhardt Island, I see I stated in the evidence here that 90 per cent of the water was on the American side. Looking up an old calculation I made, based on the cross sectional areas of the streams, I find there is about 95 per cent of the flow in American territory between those two points. There was about 3 per cent between Sheek Island and Barnhardt Island, and 2 or 3 per cent north of Sheek Island. Now, the boundary line from the head of Barnhardt Island to the foot of Barnhardt Island, according to the first treaty, passes north of that island and 300 feet from its shore. This boundary was actually laid down by metes and bounds by the International Waterways Commission in 1913. The line along Barnhardt Island is still about 300 feet from the north shore.

Hon. Mr. DANDURAND: What is the width of that channel from one island to another?

Mr. McLACHLAN: About 800 feet; at the narrowest point about 400 feet. The Commission actually laid down certain courses to be recognized in future as the boundary.

Above Barnhardt Island, in that stretch from the head of Long Sault Island to the head of Barnhardt Island, there is about 70 per cent of the flow of the river on our side of the boundary and 30 per cent on the U.S. side. Twenty per cent flows south of Long Sault Island, and 80 per cent north; but as the boundary line follows close to the north side of that island, as you can see, a small part of

the flow north of Long Sault Island passes over U.S. territory. When the whole flow over each small length is multiplied by the fall, and averaged, we may say we have about 70 per cent of the flow in this part.

Then above that, in the stretch—Morrisburg to Long Sault Island, the proportion of flow is about fifty-fifty on the two sides of the lines.

In the stretch above that the flow is in an unbalanced situation again; only about 5 per cent of the flow passes south of Ogden Island and about 95 per cent north, and as the boundary is very close to Ogden Island—only 300 feet away—about 75 per cent of the potential power would be on the Canadian side, and the balance on the American side.

Right Hon. Mr. GRAHAM: In the vicinity of Morrisburg.

Mr. McLACHLAN: From there up to the head of Galops Island it is about fifty-fifty again. So, if you total the International Rapids Section you will find that we have about 49 per cent, and they have about 51 per cent. It is very close to fifty-fifty. I went into that quite deeply in 1913. I have just now totalled up the figures computed then.

Right Hon. Mr. GRAHAM: What these people say is that in a state of nature we had practically half the flow in the vicinity of Barnhardt Island.

Mr. McLACHLAN: No. We never had more than 5 per cent, and the building of the Sheek Island dam did not rob us of more than 2 per cent of the total flow.

Hon. Mr. BEIQUE: Mr. Chairman, I would like to suggest that Mr. McLachlan prepare a statement showing the present expense of administration on each section from Montreal up, and how it is divided between the States and Canada. Those figures are in the records of the Railway Department?

Mr. McLACHLAN: Oh, yes.

Hon. Mr. BEIQUE: And another statement estimating the expense after the Welland Canal is in operation—the additional expense which will be borne by the Canadian Government—and a third estimate of the expense, and how divided between the two countries if the project as suggested by the Joint Board is carried out.

Right Hon. Mr. GRAHAM: Would not the division of the expense between the two countries depend on the treaty made?

Hon. Mr. REID: Why should we not have an opportunity of discussing that with Mr. McLachlan here? Don't you think that should go in next session?

Hon. Mr. BEIQUE: This record will go before the Committee.

Hon. Mr. REID: That is not it. This record will go before the American people and the American Government, and we should have a chance to cross-examine Mr. McLachlan on it. We want to get all the information we can.

The CHAIRMAN: Are you satisfied to leave the matter with Mr. McLachlan?

Hon. Mr. BEIQUE: Yes.

AVERAGE ANNUAL MAINTENANCE AND OPERATION COSTS OF PRESENT NAVIGATION SYSTEM—MONTREAL TO LAKE SUPERIOR

Based on Average of the Five Year Period 1922-1926 inclusive

	Section	Cost	Total
A. By Canada.—			
Lachine Canal.. . . .		\$ 302,700	
Soulanges Canal.. . . .		131,400	
Quebec Canals—General.. . . .		75,300	
Hungry Bay Dyke.. . . .		15,300	
Cornwall Canal.. . . .		168,100	
Williamsburg Canal.. . . .		79,200	
Welland Canal.. . . .		529,000	
Sault Ste Marie Canal.. . . .		73,800	
			\$1,374,800
B. By United States.—			
Detroit River.. . . .		99,400	
Lake St Clair.. . . .		31,500	
St. Clair River.. . . .		78,500	
St. Mary's Falls Canal.. . . .		248,300	
St. Mary's River.. . . .		86,000	
			543,700
Total.. . . .			\$1,918,500

NOTE:—The annual cost of maintenance and operation of lights and other aids to navigation are not included in the above statement as this expenditure will also be required for the proposed deep waterway.

ESTIMATED ANNUAL MAINTENANCE AND OPERATION COSTS OF PROPOSED DEEP WATERWAY—MONTREAL TO LAKE SUPERIOR

Scheme—Crysler Isd. Project in International Rapids Section—Hungry Bay—
Melocheville Project in Soulanges Section

	Section	Cost	Total
A. Navigation Works.—			
St. Lawrence River—			
Lachine Section—Locks.. . . .		\$ 150,000	
Bridges.. . . .		45,000	
Miscellaneous.. . . .		25,000	
14 ft. canal.. . . .		150,000	
			\$ 370,000
Soulanges Section—Locks.. . . .			
Bridges.. . . .		150,000	
Miscellaneous.. . . .		75,000	
		40,000	265,000
Lake St. Francis Section—Hungry Bay Dyke.. . . .			
Miscellaneous.. . . .		15,000	
		15,000	30,000
International Rapids Section—Locks.. . . .			
Bridges.. . . .		150,000	
Miscellaneous.. . . .		15,000	
Cornwall Canal.. . . .		75,000	
		110,000	350,000
Thousand Isd. Section—New aids to Navigation.. . . .			
		85,000	85,000
Welland Ship Canal.. . . .			1,000,000
Detroit River—as at present.. . . .		99,400	
Lake St. Clair—as at present.. . . .		31,500	
St. Clair River—as at present.. . . .		78,500	
St. Mary's Falls Canal—U.S. Canal as at present.. . . .		248,300	
Sault Ste Marie Canal—Can. Canal as at present.. . . .		73,800	
St. Mary's River—as at present.. . . .		86,000	
			617,500
Total.. . . .			\$2,717,500
B. Power Works.—			
Crysler Isd.. . . .			390,000
Barnhardt Isd.. . . .			1,040,000
Total.. . . .			\$1,430,000

Summary.—

Navigation Works..	\$2,717,500
Power Works..	1,430,000
Grand Total..	<u>\$4,147,500</u>

NOTE:—The annual cost of maintenance and operation of existing lights and other aids to navigation is not included in the above statement. The above includes the cost of maintaining such parts of the existing 14 ft. canal system as will be available for use after the deep waterway is built.

The CHAIRMAN: Mr. Lefebvre is here to-night. The address he delivered in Quebec is part of No. 5 of the printed record.

Hon. Mr. BEIQUE: It was printed before Mr. Lefebvre had corrected the translation, and it is altogether unacceptable. It is a bad translation, and Mr. Lefebvre thinks it is very unfair to him. It is not even indicated that it is a translation.

OLIVIER LEFEBVRE, Chief Engineer of the Quebec Streams Commission, Montreal, appeared before the Committee and testified as follows:—

The CHAIRMAN: First of all we would like to have your full name and occupation.

Mr. LEFEBVRE: Olivier Lefebvre. I am a civil engineer, and Chief Engineer of the Quebec Streams Commission. I was a member of the Joint Board of Engineers who investigated the question of the St. Lawrence deep waterway.

Hon. Mr. McDUGALD: Has that Board been discharged, Mr. Lefebvre?

Mr. LEFEBVRE: Not officially, anyway. I understand it is still alive theoretically; but practically it has been dead for a long time.

I wish to state that this address of mine, which I delivered in Quebec on the 7th of May last, was delivered in the French language. A translation of that address was made here by some translator connected with the Senate. I had understood that it would not be printed until I had a chance to revise the translation. I find that, through some misunderstanding, no doubt, the paper has been printed in instalment No. 5 of the proceedings of this Committee, as appendix No. 4, page 148. As it is, there is no indication that this appendix is a translation, and I appear as having written this address as it stands. It is evident that the translator of this paper, who no doubt is a very good translator, is not an engineer. He missed a lot of points, and the translation is not a good one, to say the least, and I would like to have a chance of putting in a corrected and revised translation which correctly expresses the ideas I stated.

Hon. Mr. DANDURAND: It would save time for Mr. Lefebvre to correct the document.

Mr. LEFEBVRE: I have it all corrected.

Hon. Mr. BEIQUE: You might proceed to read it, and we might put questions and take notes for questions to be asked when you are through.

The CHAIRMAN: We will leave it to you to read the material parts.

Mr. LEFEBVRE: I say that:—

I accepted with some hesitation the invitation of your president to come here and speak for a few moments on the St. Lawrence waterway. This question has been for several years now the subject of serious discussions on account of the grave consequences which may ensue from this undertaking for our country. Opinions are very sharply divided on the issue. It is with the hope of being able to shed a little light on the subject that I accepted to address you on this occasion.

Please bear in mind that the speaker is an engineer and that he is not qualified to discuss the political aspects of the question nor the international complications which it may involve.

The linking up of the important territory bordering the Great Lakes with the Atlantic ocean by a ship canal has been a subject of discussion during the past thirty years in Canada and the United States. You are, no doubt, aware that a commission of engineers was appointed in 1899 by the Government of the United States to study this question, and that the commission submitted a report in 1900.

Three routes were considered. The route favoured at that time was that of Lake Erie to Lake Ontario by means of a canal on the American side, then navigation to Oswego, N.Y., and a deep ship canal from Oswego to the Hudson River. (See Deep Waterways Board Report, 1900.)

No action was taken following this report.

In 1904, the Canadian Government with the object of facilitating the grain movement from the head of the Great Lakes to Montreal, had a study made of a ship canal scheme by way of the Ottawa River and French River. This is the Georgian Bay Canal project.

In 1920, the Government of the United States and the Canadian Government submitted to the International Joint Commission the study of a project which aimed to make the St. Lawrence navigable by deep draught ships. This Commission submitted the technical aspects of the scheme to two engineers, Lieut.-Col. W. P. Wooten, of the United States, and W. A. Bowden, at the time Chief Engineer of the Department of Railways and Canals. The report of these two engineers is known as the "Wooten-Bowden Report".

In 1921, this Commission made a report which was rather favourable to the undertaking, but it recommended that the problem be submitted to an enlarged board of engineers, and in 1924, the two Governments appointed such a board, which consisted of six members:—

American Section—

Major-General Edgar Jadwin, then assistant chief engineer of the United States Army War Department, Washington.

Colonel William Kelly, at the time chief engineer of the Federal Power Commission, Washington.

Lieutenant-Colonel G. B. Pillsbury, at the time engineer in charge of hydrographic surveys on the Great Lakes.

Canadian Section—

Mr. D. W. McLachlan, engineer in charge of the St. Lawrence, Department of Railways and Canals.

Brigadier-General C. H. Mitchell, Dean of the Faculty of Science, University of Toronto, and consulting engineer.

Mr. O. Lefebvre, chief engineer of the Quebec Streams Commission.

The two Governments submitted to these engineers a certain number of questions regarding the possibility of improving the St. Lawrence as a deep waterway. This Commission presented a report in 1927. This is the report which serves as a basis for most of the discussions on the subject.

It should be pointed out, at the outset, that these engineers did not recommend the carrying out of the scheme. They answered certain questions of a wholly technical character which had been submitted to them. The Board stated unanimously that the project was feasible with all guarantees of security. They recommended that, in order to achieve a given

result, the best plan to adopt was this or that one, for such and such a reason, but they did not state that the said plan should be undertaken. It has been wrongly stated in certain quarters that this Board reported favourably to the scheme.

Hon. Mr. McDougald: What Board are you speaking of?

Mr. Lefebvre: The Joint Board of Engineers, of which I was a member.

Hon. Mr. McDougald: That is your Board, an engineering body?

Mr. Lefebvre: Yes, but it was not within our province to state that we considered that the work should be carried out.

Hon. Mr. McDougald: That is quite clear.

Mr. Lefebvre: Then I describe the actual conditions of the river.

Hon. Mr. McDougald: Didn't you say it was stated elsewhere that you had recommended that the works should be started at once?

Mr. Lefebvre: Yes.

Hon. Mr. McDougald: Would you mind stating by whom or what body?

Mr. Lefebvre: I saw a statement to that effect in the Weekly Bulletin which is issued from Washington by the Great Lakes-St. Lawrence Tidewater Association. I suppose you saw the same thing.

Hon. Mr. McDougald: I just wanted to know.

Mr. Lefebvre: That is where I read about it. Then there is a chapter on the actual conditions in the river.

Hon. Mr. Murphy: Page 150 of this pamphlet.

Mr. Lefebvre: Yes.

For the purposes of navigation the St. Lawrence may be divided into three sections: that of the Gulf of St. Lawrence up to Montreal—a distance of about 1,000 miles, and navigable by ocean-going ships with 30 feet of draft. This navigation has been made possible by dredgings, more particularly above Quebec, which have cost Canada in the neighbourhood of \$32,000,000. The work of deepening the river is being continued with the object of increasing the available depth to 35 feet. The harbour of Quebec, whose importance is increasing rapidly, and into which ocean liners of the greatest tonnage may find a berth, is situated in this section. The season of navigation covers, on an average, a period of about $7\frac{1}{2}$ months, from April 15th to the beginning of December. The second section, from Montreal to the foot of Lake Erie, at Port Colborne, covers a distance of 368 miles. Within this stretch there is a rise of 552 feet—a rise which is overcome by canals and locks opposite the falls and rapids. The depth of the canals accommodate boats with 14 feet of draft.

In that section the first obstacle is the Lachine Rapids between Montreal and Lake St. Louis, where there is a fall of 45 feet, overcome by the Lachine Canal. Length of the canal, $8\frac{1}{2}$ miles; five locks.

The second obstacle occurs between the head of Lake St Louis and the foot of Lake St. Francis—a distance of 16 miles—where the rapids of Coteau, the Cedars and the Cascades are located. Difference of level between the two lakes, 83 feet. This distance is navigated through the Soulanges Canal. Length of the canal, 14 miles; four locks.

The third obstacle: At Cornwall the river becomes an international waterway. The Long Sault Rapids, which are overcome by a lateral canal and six locks commence near Cornwall. Length of the Cornwall Canal, 11 miles. There is a fall of 48 feet in the Long Sault Rapids. Then there is another lock at Farran's Point. Length of the canal, $1\frac{1}{2}$ miles. At Morrisburg, at the Rapide Plat, the length of the canal is $3\frac{3}{4}$ miles, and there are two locks. Finally there is the canal with three locks between Iroquois and the head of the Galops rapids at Cardina, a few miles below Prescott. Length of the canal, $7\frac{1}{2}$ miles. From the

head of the Galops Rapids, which is 110 miles from Montreal, where the control section of Lake Ontario is located, to the head of Lake Ontario there is open navigation for a distance of about 225 miles. The Niagara River and Niagara Falls are between Lake Ontario and Lake Erie. The total difference in levels is 326 feet, which is overcome by the Welland Canal. Length of the canal, 26 $\frac{1}{2}$ miles; 25 locks.

Right Hon. Mr. GRAHAM: By "open navigation" you mean no locks or rapids?

Mr. LEFEBVRE: That is it.

Hon. Mr. REID: That is between what points?

Mr. LEFEBVRE: The Galops Rapids at Cardinal, and Port Dalhousie, at the head of Lake Ontario. The total difference in levels between Lake Ontario and Lake Erie is 326 feet, which is overcome by the Welland Canal.

Right Hon. Mr. GRAHAM: That is the present canal?

Mr. LEFEBVRE: The present 14-foot canal.

The third section is that of the Great Lakes, where a depth of 20 feet has been made possible by deepening certain of the channels connecting these lakes, such as the Detroit River between Lake St. Clair and Lake Erie—a distance of 28 $\frac{1}{2}$ miles; Lake St. Clair, 14 miles; the St. Clair River between Lake Huron and Lake St. Clair—a distance of 39 miles; and finally the St. Mary's River between Lake Superior and Lake Huron—a distance of 64 $\frac{1}{2}$ miles. Lake Superior is 600 feet above sea level, whereas Lake Huron and Lake Michigan are at 580 feet. The difference of 20 feet is to be found in the slope of the St. Mary's River, and in the rapids or falls of 18 feet at Sault Ste. Marie. This rapid is overcome by locks, four on the American side and one on the Canadian side. Two of the American locks have a depth of 24 $\frac{1}{2}$ feet over the sills. The Canadian lock has a depth of 18 feet.

Therefore, ocean navigation with a draft of 30 feet and more as far as Montreal; navigation at 14 feet from Montreal to Port Colborne, at the foot of Lake Erie; navigation at 20 feet on the Great Lakes, as far as the head of Lake Superior.

Then I come to the cost of the present canals.

COST OF CANALS

The canals mentioned in the second section (from Montreal to Lake Erie) are all located in Canadian territory. They were constructed and are maintained by the Government of Canada. Our country made a capital outlay of \$69,000,000 for their construction. You are aware that a new Welland Canal is under construction and that it is estimated it will be completed in 1930. It will provide a depth of 27 $\frac{1}{2}$ feet in the reaches, and a depth of 30 feet in the locks. In 1930 it will be possible for the largest lake boats to enter Lake Ontario and to navigate as far as Prescott, 115 miles from Montreal. The cost of the new Welland is estimated at \$115,000,000.

IMPROVEMENTS IN THE GREAT LAKES

If all the canals in the second section have been constructed by Canada, at Canada's expense, it is but fair to say that the improvements in the rivers connecting the Great Lakes were carried out almost exclusively by the United States Government, at a cost of about \$46,000,000.

Right Hon. Mr. GRAHAM: Some of them, at least, are on the Canadian side?

Mr. LEFEBVRE: I am coming to that in a minute. The improvements include the locks at Sault Ste Marie. The channels thus improved are not all located in American territory. The Livingstone channel, in the Detroit River,

is largely in Canadian territory. The Amherstburg channel in the same section of the Detroit River is wholly in Canadian territory; the first is used by down bound vessels and the second by up bound vessels. Canadian boats use them on the same basis as American boats—just as the latter make use of our canals. The Government of Canada has spent about \$6,000,000 for the lock at Sault Ste. Marie.

DEEP WATERWAY

The present system of navigation requires a transfer of export cargoes at two points: first at the foot of Lake Erie, then at Montreal. It is believed that there is an advantage in doing away with this transshipping from one vessel to another if the St. Lawrence were deepened and improved to accommodate vessels of greater draft. This undertaking is what is generally called: "The St. Lawrence Deep Waterway."

The problem submitted to the engineers was that of determining if such a project could be carried out, the best plan of carrying it out and the probable cost of same. In view of the fact that the falls and rapids on the St. Lawrence have a potentiality of approximately 5,000,000 h.-p. of which 3,000,000 are in the Canadian section and 2,000,000 are in the International section, and that it is desirable to utilize this power for the industrial development of the two countries, would it be possible to improve the St. Lawrence for the production of that power. The investigation had reference to the following questions: What would be the cost of improving the river for navigation alone and what would be the cost of improving this river for power alone? What would be the cost of a combined plan of improvement? Would it be advantageous to carry out the combined projects? At this point, by having suitable maps, I explained the plan we were recommending to improve the different sections.

The St. Lawrence has, as you know, a drainage basin of about 375,000 square miles at Montreal. It has a flow which is extraordinarily regular. In fact, it is the best regulated river in the world. At the outlet of Lake Ontario, the maximum flow registered was 320,000 second feet, and the minimum flow 180,000 second feet. The ratio between the extreme maximum and the extreme minimum was less than 2 to 1. On the St. Maurice for instance, the ratio is 25 to 1; on the Ottawa river, the ratio is 10 to 1.

NAVIGATION ALONE

One of the problems to be solved was an improvement of the river above Montreal, and as far as the head of the Great Lakes for navigation alone.

The problem looking to the improvement of navigation alone is easy enough, since in every case, with the exception of one short section, the depth is secured by means of lateral canals with locks, at an estimated cost of \$167,-200,000.

Hon. Mr. REID: That is from Montreal to the head of the Great Lakes?—A. That is from Montreal to Lake Ontario—to the foot of Lake Ontario.

The exception mentioned is in the reach just above the head of the Long Sault Rapid, where it is cheaper to use the river for a certain distance—which would require the construction of a low dam. All these works for navigation alone in no wise affect the flow of the river, and involve no engineering difficulties whatever.

WATER-POWER

This is not the case when one considers the improvement of the river for power. The concentration at given points of the available heads requires extensive changes in the sections and rather complicated compensating works, if one is to provide the necessary safeguards against damage-claims and disasters.

You probably know that ice constitutes one of the most difficult problems in the St. Lawrence and creates a situation which calls for very careful study if a definite and effective solution is desired. For instance, the sections of the rapids do not cover with ice. This stretch of open water exposed to the cold air forms frazil which is carried along by the current and gathers in the parts of the river where the surface is ice covered, and packs at the surface if the velocity of the current does not exceed $2\frac{1}{2}$ feet per second or is carried under the ice if the current exceeds $2\frac{1}{2}$ feet per second. This process of ice formation goes on throughout the whole winter. The Lachine Rapids and the foot of Lake St. Louis are responsible for the Laprairie basin and the harbour of Montreal being filled with ice, frazil (which the French call "Glace en Sorbet."). This ice forms an obstruction and raises the water in the harbour from 10 to 12 feet higher than the summer level. This phenomenon is due solely to the obstruction caused by the ice. Lake St. Louis covers with ice, but the rapids of Coteau and the Cedars always remain open, and the same phenomenon of the production of ice and frazil is repeated with the result that the surface of Lake St. Louis, which should be practically level, rises at the head of the lake as much as 7, 8, and even 10 feet above the normal summer level so that at a certain time a portion of the water of the St. Lawrence flows into the Ottawa River channel at Vaudreuil into the Lake of Two-Mountains whereas normally it is the Ottawa river which flows into the St. Lawrence by that channel. The same ice phenomenon occurs in the international section of the river between Prescott and Cornwall. The ice piles up at the foot of the Long Sault Rapids and often causes very damaging floods at Cornwall, in the middle of winter. From Prescott to Kingston the river covers with ice in a normal way. Lake Ontario does not freeze, neither do the other lakes, with the exception of Lake St. Clair, which in area might be compared with our own Lake St. John.

To ensure the operation during the winter months of hydro-electric power-houses erected on the St. Lawrence river, it is essential that the upper reach be covered with a sufficient ice cover to prevent the frazil from reaching the power-house. To achieve this object, the section of the river in the rapids must be enlarged to a point where the velocity of the current will not be more than $2\frac{1}{2}$ feet per second, or at all events, that the surface of water exposed to the air and producing frazil will be reduced to a point where the frazil that is formed may be stored in the deep part of the head race, without retarding the regular flow of the river.

The concentration in generating plants can only be attained by means of dams built across the river, or by the diversion of the waters into lateral head-races excavated for this purpose. At all events, the plan found to be the cheapest was that which uses the river, taking all factors into account; necessary deepening in the rapids, in order to secure a current which would practically eliminate the formation of frazil, and ensuring a regular and uniform flow of water to the various power-houses. In summer, the enlargements of certain sections are necessary in order to avoid back water and head losses.

COST OF THE COMBINED IMPROVEMENT

It has been found that navigation, between Lake Ontario at Kingston, and Montreal, for a depth of 25 feet with locks at 30 feet, may be secured at a cost of \$167,000,000. It has also been established that, in order to improve the river for power alone in the same section, the cost would total \$533,000,000 for a power-house capacity of 5,000,000 horse-power. By combining the two improvements the cost would be \$650,000,000. An economy of \$50,000,000 would be realized. If one adds the cost of the Welland canal, \$115,000,000, the cost of deepening the rivers connecting the Great Lakes and that of the com-

compensating works, estimated at \$44,000,000, one reaches a grand total of \$799,000,000. Once again, this estimate provides for hydro-electric plants with a capacity of 5,000,000 horse-power. Of this quantity of power 2,000,000 horse-power in round figures are located in the international section from Cornwall upstream, and are to be divided equally between the two countries. The balance, 3,000,000 horse-power, is available in the essentially Canadian section of the river, which is wholly in the province of Quebec, namely, 2,000,000 in the Soulanges section and 1,000,000 in the Lachine section. It goes without saying that the installation of the power generating units may be made when the power may be disposed of and our industrial progress demands it.

NO EXPORT OF POWER

It is well understood, and it is a policy approved by the greatest majority—that is about the only point on which everybody is in agreement—that the power that will be generated from our section of the St. Lawrence must be utilized at home and will not be exported to the United States. Moreover, I believe that American opinion accepts this situation with good grace, and that our friends in the United States are not counting on receiving from the St. Lawrence any other electrical power but that which rightfully belongs to them. They desire the improvement of navigation; they want to make it possible for vessels of the Great Lakes to reach Montreal or Quebec, or even enter the gulf. They believe that ocean steamers will travel up to the head of the Great Lakes: Chicago, Duluth, Fort William.

ESTIMATES

The estimates prepared by the engineers have caused some criticism. Comparisons have been made. The estimate of \$252,000,000 made by Messieurs Wooten-Bowden in 1921 has been compared with the estimate of \$650,000,000 mentioned in the last report, and this has led to the statement: what was to cost \$252,000,000 in 1921 is estimated at \$650,000,000 in 1927. Hence the deductions.

In the first place, a comparison is made between two plans which are not comparable because they do not cover the same items. The estimate of 1921 only covers the section between the foot of Lake Ontario and Montreal. In addition, the estimate only deals with the development of 1,464,000 horse-power in the international section. It does not include any power development in the essentially Canadian section. If the two estimates are placed on the same basis, it will be found that they are not very far apart.

It is generally stated that the engineers' estimates are insufficient. I am in a position to tell you that the estimates embodied in the report which was submitted last year were prepared with the greatest care. Nothing was overlooked in the way of determining the exact nature of the foundation, the ground which would require excavation, and finally all the factors which would have any bearing on the cost of the works. Strangely enough, it is whispered in certain quarters that the estimates are too high. That is, the unit prices we have used have been stated to be too high.

MAINTENANCE OF A UNIFORM FLOW

In considering the problem of the development of the St. Lawrence and its improvement both for navigation and for power, there are certain guiding principles which must be kept in mind. For instance, the uniform flow of the St. Lawrence must be maintained at all costs. It must be guaranteed. The level of the St. Lawrence river at Montreal is seasonally regular and free from sudden fluctuations, because the discharge from Lake Ontario is seasonally regular and uniform. On the other hand, the volume of water utilized by hydro

power plants is, with rare exceptions, very variable. It varies directly with the quantity of power supplied to the customers. You all know what we call the load factor. It is the ratio between the peak load and the average load of a period consisting generally of twenty-four hours. The power generating plants which will be installed on the St. Lawrence will be subject to the same conditions. The load factor may possibly be closer to unity. Whatever the factor may be, it is essential that the flow of the river must not change with the load, which amounts to this, that the maximum to be allowed for the power-generating plants must correspond to the power which an average available flow can produce. In this way, when the water is not required at the plant, it will not be stored up in a pond formed by a dam or into a lake, but it must be allowed to run out by means of sluice-gates built outside of the plant, in a weir constructed for this purpose. It is an exceedingly important principle if one is to retain for our river its navigable character.

All the commissions of engineers were unanimous in laying down this principle which must be applied not only to the international section but also in the Soulanges section and in the Lachine section. It is the method to be followed in order to ensure a uniform flow that caused the two sections of the board to differ with respect to the plan for the International Rapids section. The Americans favour what is known as the "single-stage development", a concentration at one point of all the fall between Prescott and the foot of the Long Sault Rapids at Cornwall, by means of a dam located at either the head or at the foot of Barnhardt Island, but the power plant would in both cases be located at the foot of Barnhardt Island. And this means that the flow from Lake Ontario would be controlled by a dam connected to a power station having a capacity in excess of 2,000,000 horse-power. The flow in such a plant may vary to a very considerable degree. As the stretch of water above the dam is Lake Ontario, which has an area of 7,500 square miles, the flow may be retarded with little effect on the level of this sheet of water, but the effect might be positively disastrous to that section of the river below the dam.

We insist that the control of the flow from Lake Ontario be not connected with a power plant having a capacity of several million horse-power. The ideal plan would be the construction of a control dam for the flow only. But as this plan would involve the loss of a certain quantity of power which may become very valuable, and which has an important value to-day, we have agreed to connect this dam with a hydro-electric plant of much lesser proportions, and which can be operated as a basic plant with a uniform load twenty-four hours a day. It is readily conceivable that this plant may be connected with a system in which the variations in load will be absorbed by other units in the system. For this reason we favour concentration at two points—"the two-stage development". The control dam for Lake Ontario would be at Crysler Island, a few miles below the town of Morrisburg.

Hon. Mr. REID: Excuse me. You say "we favour". That is, the Canadian section of the engineers favour that?

Mr. LEFEBVRE: Yes, sir.

Hon. Mr. REID: That is not the whole Board?

Mr. LEFEBVRE: I make that clear.

Hon. Mr. REID: You do? All right.

Mr. LEFEBVRE: That is really what "we" stands for. The control dam for Lake Ontario would be at Crysler Island, a few miles below the town of Morrisburg. The head available would be 24 feet. The other concentration would be at Barnhardt Island, at the same point favoured by the American section—a head of about 60 feet. The dam at the head of Barnhardt Island will be pro-

vided with a long spillway, and if the volume of water in the plant be reduced, the pond between the two power-houses, which is limited to the area of the river, will rise very rapidly, and in a very short while the flow will run out by the spillway which I have just mentioned. This plan insures the uniformity of the discharge from Lake Ontario, and I repeat once more that this is the essential thing, not only in the interest of good navigation at Montreal, but also to safeguard the value of the water-power in the Canadian section of the river. It is quite true that this plan would involve an outlay of \$34,000,000 more than the sum required to carry out the single-stage plan, but the security of the level in the port of Montreal and of the level below Montreal is worth more than this slight difference. Moreover, control by means of two dams makes provision for greater security against accidents, chances for which are very remote, but nevertheless quite possible.

Then I give some extracts of the report—

Hon. Mr. BEIQUE: In order to have a proper connection let me ask, with the two sections is there any danger?

Mr. LEFEBVRE: I beg your pardon?

Hon. Mr. BEIQUE: If the two-stage project be adopted, is there any danger of the dam being carried away?

Mr. LEFEBVRE: I may say that the element of danger in both cases is exceedingly remote.

Hon. Mr. L'ESPERANCE: Is it there just the same?

Hon. Mr. BEIQUE: Is it diminished by the two-stage development?

Mr. LEFEBVRE: It is still more remote in the case of the two-stage development.

Hon. Mr. MURPHY: What were you going to say about those extracts, Mr. Lefebvre?

Mr. LEFEBVRE: Following are extracts from the report itself.

Hon. Mr. MURPHY: Of the Joint Board of Engineers?

Mr. LEFEBVRE: Of the Joint Board of Engineers, making it clear that the principals which I have just enunciated there are paramount.

For example, paragraph 109 is entitled,—

"Fundamental Principles":

"The plans have been prepared in accordance with the recognized principle that the interests of navigation on the St. Lawrence are paramount. A full observance of this principle does not interfere with the beneficial use of the flow of the river for power generation. On the contrary, the improvement of the rapids sections of the river for the joint benefit of navigation and power affords, as a rule, much better navigation than could be secured by the improvement now economically justifiable in the interest of navigation alone."

Then paragraph 116:—

"The various power houses have the capacity for the development of the maximum flow which the Board considers as utilizable in the future. The interests of navigation require that the flow down the St. Lawrence be maintained at a high degree of uniformity, and prevent the maximum use of water for power by fluctuating the hourly flow to meet the fluctuating power demand. An installed capacity well in excess of the minimum flow of the river has been provided, however, since the increasing value of power will justify its eventual development from the flow available during high-water periods only."

Then paragraph 218:—

"The improvement of the St. Lawrence river could affect the water levels at and below Montreal to the extent only that the works might be so operated as to modify the rate of discharge of water down the river. The program for the regulating of lake Ontario recommended by the Board is so drawn as to afford mean discharges during the critical months of September, October and November at least equal to the discharges that occur in nature; and discharges in the half of April, when the river has its maximum flood levels, no greater than those that would occur with equal frequency without regulation. There remains the possibility of the introduction of fluctuations in the discharge of the river through the fluctuations in the discharges through the power plants to meet their changing loads."

Then paragraph 219:—

"Any necessary uniformity of discharge past the various power structures can be secured by opening sluice gates as the power load and power house discharge diminishes. Power can be profitably generated at the various plants recommended by the Board without causing any greater hourly and daily fluctuations in the water levels at Montreal than now occur from natural causes, and suitable government supervision, both over the plants in the International Section and over those in the province of Quebec, can assure this result."

Then paragraph 234 is in answer to question 5, which reads as follows:—

"To what extent may water levels in the St. Lawrence River at and below Montreal, as well as the river and lake levels generally, be affected by the execution of the project?"

Answer:—

"The irresponsible operation of the power works proposed by the Board, or indeed any power works, however designed, that develop fully the power resources of any section of the river, would affect injuriously the water levels in the St. Lawrence river at and below Montreal; but it is feasible to operate these works under government supervision in such manner that they will neither lower the summer levels in the lower river nor raise the winter and spring levels. With such control the improvements proposed will have no injurious effect whatever on the water levels of the St. Lawrence at and below Montreal."

REGULATION AND CONTROL OF DISCHARGE FROM THE LAKES

I would like to point out that the possibility of regulating the discharge of the Great Lakes with a view of improving it, if possible, has been the subject of a thorough study. This study has shown that no improvement can be carried out which warrant the extraordinary expenditure it would involve.

You are, no doubt, aware that certain interests in the Great Lakes have proposed that the level of the Great Lakes be controlled with the object of maintaining a given minimum. Now the Great Lakes are the basins which feed the St. Lawrence, which regulate its flow. When the supply of water is very great the lakes rise and retain a large proportion of the supply. On the other hand, when the supply is small, the St. Lawrence is fed by the storage in the lakes, the level of which then recedes. If it be planned to instal control works that would prevent the level of the lakes from receding during a certain period, this would prevent the lakes from performing their function, that of feeding the St. Lawrence. This is a project which must be opposed every time it is put

forward. A calculation based on the conditions that obtained in the month of September, 1925, proves that in order to prevent the level of the lakes from receding during that month, the discharge would have had to be reduced by 142,000 cubic feet per second. Now then, what would be the effect of such a reduction at Montreal? The Lake Ontario level would have dropped about two feet, and in the harbour of Montreal the drop would have been greater, since the level of the harbour under normal conditions drops one foot when the discharge is decreased by 23,000 cubic feet per second.

DIVERSIONS

Another interesting point is the effect of the diversion of water at Chicago on the level of the lake and the level of the river. This diversion caused a lowering of about six inches in the level of Lakes Huron, Michigan, Erie and Ontario. The level of Lake Ontario was restored by the construction of a dam between two islands at Galops Rapids—a dam which is known as the "Gut Dam". The water diversion at Chicago results in a lowering of the level at Montreal by $4\frac{1}{2}$ inches. This effect does not increase. It is definite and will not increase if the volume of water diverted is not increased. It will decrease if the volume of the diversion decreases.

The lowering of the level may be remedied by means of compensating works. At the outlet of Lake Michigan and Huron these works would take the form of submerged weirs in the St. Clair river which would spread over a great distance the additional slope it is desired to secure. At the outlet of Lake Erie, in the Niagara river, compensating works that would restore the level of Lake Erie could be carried out. The estimated cost of all these compensating works is \$3,100,000.

There is one thing, however, which the Chicago diversion causes, and for which there is no remedy. This is the loss of power represented by 8,500 second-feet on the available head. This loss amounts to 161,000 horse-power in the section of the river between Prescott and Montreal. With respect to the loss which this diversion of water represents at Niagara Falls, Canada may be compensated for same by a distribution of the amount of water authorized to be diverted from the Falls. At the present time the volume of water diverted at Niagara Falls under the terms of a Treaty between the two countries is 56,000 cubic feet per second, of which 20,000 are on the United States side and 36,000 on the Canadian side. There is a proposal to increase this volume to 80,000 cubic feet per second, if it can be proven that such a diversion will not affect the grandeur nor mar the beauty of Niagara Falls.

There are several water diversions throughout the whole St. Lawrence system—most of them for the purpose of generating power. At the outlet of Lake Superior, at Sault Ste. Marie, 50,000 cubic feet per second are diverted, of which 30,000 are on the American side and 20,000 on the Canadian side.

To compensate for this diversion on Lake Superior, a dam which serves to control the discharge from the lake was constructed in St. Mary's river. This dam is under the control of the International Joint Commission. This diversion does not affect the levels below.

Right Hon. Mr. GRAHAM: Who built that dam? Who expended the money for constructing that dam?

Mr. LEFEBVRE: I think the cost of this dam was paid for by the power companies.

The most important water diversion outside of Chicago is that at Massena. Between the St. Lawrence river at the head of Long Sault Island and Massena, N.Y., on the Grasse river, there is a drop of 42 feet. The river at Massena is three miles from the St. Lawrence. A feeder canal was excavated whereby 23,000 cubic feet per second are diverted for the generation of 86,000 horse-

power, used for the manufacture of aluminum. This water again finds its way into the St. Lawrence by the Grasse river, and in no wise affects the level of the river on our side.

Right Hon. Mr. GRAHAM: Massena is in New York state.

Mr. LEFEBVRE: Yes, sir.

Hon. Mr. REID: You say that does not affect the water in the St. Lawrence?

Mr. LEFEBVRE: I beg your pardon?

Hon. Mr. REID: I understood you just now to say that it does not affect the level in the St. Lawrence.

Mr. LEFEBVRE: I mean, it does not affect the level in the St. Lawrence below.

Hon. Mr. REID: Yes, that is exactly the point. But above the rapids?

Mr. LEFEBVRE: That is, the local effect.

Hon. Mr. REID: Where the intake is.

Hon. Mr. MURPHY: The word "below" is in the printed copy, Mr. Lefebvre. Do you intend it to remain?

Mr. LEFEBVRE: This diversion does not affect the levels.

Hon. Mr. MURPHY: "This water again finds its way into the St. Lawrence by the Grasse river and in no wise affects the level of the river below on our side."

Mr. LEFEBVRE: That is it.

Hon. Mr. MURPHY: You intend that word "below" to remain?

Mr. LEFEBVRE: Yes.

Hon. Mr. MURPHY: That answers Doctor Reid.

Mr. LEFEBVRE: It in no wise affects the level of the river below on our side.

Hon. Mr. REID: Then I asked the question whether it did above, on account of that extra water going through this canal.

Mr. LEFEBVRE: I do not think so, Senator, because they have choked the flow through the South Sault channel by this submerged weir.

Hon. Mr. REID: Yes, I see. Of course the submerged weir would raise it, unless that were to be only temporary. Of course if you leave it there permanently that would be compensating works for that canal.

Right Hon. Mr. GRAHAM: But, Mr. Lefebvre, just on that point, was it not admitted that diversion did affect the level above, because certain works had to be done on the Canadian canals to protect them from that diversion, and the Aluminum Company paid the cost of those improvements to the Canadian canals?

Mr. LEFEBVRE: Yes, but I only mention that it does not affect below. I was speaking more particularly of the Quebec section there.

Right Hon. Mr. GRAHAM: I am just bringing it out clearly.

Mr. LEFEBVRE: Then the submerged weir as it stands to-day has caused a rise in the level of the St. Lawrence river above the power canal.

Hon. Mr. REID: Equal to about what the power canal would amount to?

Mr. LEFEBVRE: More—more.

Hon. Mr. McLENNAN: That is, the navigation above is equally good and below it is equally good?

Mr. LEFEBVRE: Below the Long Sault Rapids it is equally good.

Hon. Mr. McLENNAN: The water returns by the Grasse river—

Mr. LEFEBVRE: It is not affected in any way.

Hon. Mr. McLENNAN: Just as much water returns; and the submerged weir keeps the level up above.

Mr. LEFEBVRE: The submerged weir has had the effect of causing a rise in the level above, which rise has necessitated, as Senator Graham has just said, certain works which have been carried out in the canals.

Right Hon. Mr. GRAHAM: Would it be disconcerting you if I asked you this question? You speak of diversions at Niagara Falls and other places. In any of these diversions was the water returned to the lake?

Mr. LEFEBVRE: All the diversions are coming back to the St. Lawrence, except that at Chicago.

Right Hon. Mr. GRAHAM: They come back into the lake?

Mr. LEFEBVRE: Yes.

Right Hon. Mr. GRAHAM: Then, so far as below Niagara is concerned, these diversions do not affect the water?

Mr. LEFEBVRE: Not at all.

Then the next chapter is a short discussion of the possible effect of the improvement on the freight rates. The effect of this improvement on the transportation charges is a matter of discussion. Certain enthusiastic supporters of the project speak of a reduction of 10 cents per bushel in the grain carrying rates. There are others who assert that there will be no change whatever in the freight rates. During the past few years the cost of grain transportation from Fort William to Port Colborne has been on an average 3 cents per bushel. This rate will not be lowered as a result of the proposed improvement. The distance between Fort William and Port Colborne is 850 miles, and requires a lockage lift of 18 to 20 feet at Sault Ste. Marie. The average time required for this lockage in 1925 was 1 hour and 9 minutes, inclusive of the delay incidental to the entry into the canal and the exit therefrom. (See paragraph 139, Appendix "B".) If one deducts the delay, the lockage itself took an average of 52 minutes. This demonstrates the importance of the vertical distance. From Port Colborne to Montreal, the distance is 368 miles, but the vertical drop which must be overcome by canals and locks is 540 feet. This vertical distance is equivalent to a horizontal distance of about 300 miles, for the average freighters on the Great Lakes.

Hon. Mr. McLENNAN: That means, taking the average speed of the freighter, the lockages would be equivalent to 300 miles?

Mr. LEFEBVRE: Yes. That is my opinion. Under present conditions, the cost of grain transportation, including the transshipment charges between Port Colborne and Montreal, works out at about 6 cents per bushel. This is the only section of the river where a reduction in transportation costs is anticipated. What will this reduction amount to? The most competent authorities have stated that this reduction may reach a maximum of 3 cents. It can only apply to grain tonnage which will be carried mainly by this improved route. On the basis of wheat, this reduction would equal \$1 per ton. As the capacity of the projected canal is 24,000,000 tons per year, the maximum amount that could be saved on this basis would be \$24,000,000.

Hon. Mr. SMITH: That is comparing the cost before the Welland canal is finished—as it is now—with the cost you anticipate if there were a deep waterway?

Mr. LEFEBVRE: Yes, sir.

Hon. Mr. SMITH: What proportion of that do you estimate would be saved when the Welland canal is finished?

Mr. LEFEBVRE: I have not looked into that question at all.

Hon. Mr. McLENNAN: Do you accept this 3 cents as accurate?

Mr. LEFEBVRE: Yes, sir.

Last year cargoes totalling 7,200,000 tons passed through the Welland canal. The economy effected would, therefore, be \$7,000,000. \$24,000,000 is the maximum saving which may be hoped for. Can this maximum be realized?

Hon. Mr. GILLIS: Is that grain alone?

Mr. LEFEBVRE: It would apply to all kinds of freight, I take it.

Right Hon. Mr. GRAHAM: Do your figures depend at all upon return cargoes?

Mr. LEFEBVRE: Well, I must say that the figure of the saving of 3 cents is based on the assumption that these bulk freighters will have to return empty from Montreal.

Right Hon. Mr. GRAHAM: Any cargo they got westward would aid in reducing their cost of transportation?

Mr. LEFEBVRE: Yes. But they are bulk freighters, and it is not easily seen that they could possibly get some bulk freight from Montreal to take west. At any rate, the calculation has been made on the basis of returning empty from Montreal to the foot of Lake Erie.

Hon. Mr. REID: Is the saving of 3 cents based on all grain being transferred at Montreal? When the whole canal is completed, are your figures of 3 cents a bushel saving on grain based on all the grain going through in vessels from Port Arthur to Montreal?

Mr. LEFEBVRE: Yes, sir.

Hon. Mr. REID: Would there be a further saving if the ocean going vessels came right through to Port Arthur?

Mr. LEFEBVRE: I doubt it very much.

Hon. Mr. REID: Then it is your impression that ocean going vessels will not pass Montreal?

Mr. LEFEBVRE: Oh that is another consideration altogether.

Hon. Mr. SMITH: In that saving of 3 cents, how much is saving in elevator charges at the two ends?

Mr. LEFEBVRE: My understanding is that the present rate of 6 cents includes transfer charges at both ends; therefore the saving of 3 cents includes the elimination of one transfer charge only.

Right Hon. Mr. GRAHAM: At Port Colborne?

Mr. LEFEBVRE: Port Colborne would be eliminated, but you would still have the charge at Montreal.

Hon. Mr. REID: Pending the completion from Prescott down, what would be the saving?

Mr. LEFEBVRE: I have not figured that out?

Hon. Mr. SMITH: Is it fair to assume that since the distance from Port Colborne to Prescott is three-fifths of the total distance, and the drop at Niagara is three-fifths of the total drop, that the saving would be three-fifths of the 3 cents on the completion of the Welland canal?

Mr. LEFEBVRE: On the face of it that would seem to be a fair assumption.

Traffic on the Great Lakes in 1926 totalled 121,000,000 tons, divided between four main commodities, namely: iron ore, from the mines on Lake Superior to the harbours on Lake Erie, 63,000,000 tons; coal traffic to the West, return traffic, 31,000,000 tons; crushed stone, 14,000,000 tons; grain, 12,000,000 tons.

Hon. Mr. McLENNAN: Is that crushed stone business a permanent business?

Mr. LEFEBVRE: Oh, yes. A large proportion of that is limestone which is used for flux in the blast furnaces.

Hon. Mr. McLENNAN: It has nothing to do with the building of the new canal.

Mr. LEFEBVRE: These products are carried as bulk cargoes. The balance of the traffic is largely made up of package freight, which only represents a very small portion of the total traffic. Iron ore will not be transported by way of the improved canals. It is used in the blast furnaces in the Pittsburgh district and in the ports of Lake Erie. Coal is shipped to us from the ports on Lake Ontario. It is doubtful whether the improvement contemplated will have the least effect on the freight charges for this kind of merchandise. Crushed stone and gravel constitute a very important local traffic which, however, will not extend beyond the Great Lakes. Grain is the only article which may increase the traffic on the Great Lakes, and this traffic will probably show a very large increase.

What the package freight to be developed on the St. Lawrence route will amount to is problematical. On the other hand, it must be borne in mind that the fixed charges, interest, and maintenance of the canals will be several million dollars greater than they are to-day. There are no toll charges on the canals, which are free to navigation.

Then there is another aspect of the deep waterway project to which attention must be called, and that is the necessity of separating the cost of navigation from the cost of power development. The canals of Canada have been declared to be public works which have been carried out for the greatest advantage of the country, and their cost is paid by the whole country. Water power must be paid for in the final analysis by the consumer of electric current. Now, the Government is being advised from certain quarters to deviate from this principle, and the following proposal is put forward: The St. Lawrence deep waterway may be carried out without entailing any cost to the country in addition to those expenditures which we are committed to, such as the Welland Canal. Here is the proposal: As an offset to our expenditures for the Welland Canal and the deepening of the St. Lawrence below Montreal, the United States would be asked to undertake at their own expense the works projected in the International Section of the river for the improvement of navigation and the development of power. Canada would take her share of the completed works, including half of the power. As regards the National or Canadian section of the river, the section situated wholly in the Province of Quebec, it is submitted that the producers of the hydro-electric power—private interests probably, but the principle would be **the same in case of a Government organization**—would be prepared to provide the country with improved navigation free of charge in exchange for the privilege of developing the water power, and here you have a completed deep waterway project without any further cost to the Federal Treasury.

It is nevertheless interesting to ponder for a minute and ask oneself who is going to assume the function of the Federal Treasury, because, after all is said, this improved navigation, the cost of which is estimated at from \$86,000,000 to \$90,000,000, must be paid for by somebody. The canals cannot provide any revenue, as they are free. The only source from which these producers of power, or private interests, could derive revenue would be the sale of power. Consequently, it is self-evident that the cost of navigation, which would be added to the normal cost of their power development, would be paid by the consumer of electric current. This method would be extremely unfair to the Province of Quebec, which would be called upon to pay in the final analysis the cost of an improved navigation that is designed to benefit, and is demanded by interests outside the limits of that province.

This proposal is embodied in the report of the National Advisory Committee, as follows:—

We believe that if a reasonable time were permitted—

Hon. Mr. McDougald: Do you take out the word "seriousness" there?

Mr. Lefebvre: Yes. I say this report is put forward.

Hon. Mr. McDougald: "This proposal is put forward in all seriousness."

Mr. Lefebvre: This proposal is put forward. I should say that this proposal is embodied in the report. That is what I mean.

We believe that if a reasonable time were permitted in which to enable the resultant power to be economically absorbed, the development of this national section would be undertaken by private agencies able and willing to finance the entire work, including the necessary canalization, in return for the right to develop power.

Messrs. Beaudry, Leman, and the Hon. Adelard Turgeon declined to assent to such a proposal, and it is hoped that the Federal Government will not entertain it.

Hon. Mr. McDougald: Were you a member of the Advisory Board of Engineers when you made that speech?

Mr. Lefebvre: I am yet a member of the Joint Board of Engineers.

Hon. Mr. McDougald: And were you speaking for yourself in that last paragraph, or for the province, or the Quebec Streams Commission, or the Joint Board of Engineers?

Mr. Lefebvre: I was speaking purely as a citizen of the province of Quebec.

Hon. Mr. Beique: Expressing your opinion from the study you had made?

Mr. Lefebvre: Yes.

Hon. Mr. McDougald: But still a member of the joint engineering body advising the advisory board. That is all.

Mr. Lefebvre: What we require in the province of Quebec is cheap power that will bring large industries into our midst and keep our population at home. The system that is proposed is not designed to give us this result.

Allow me to convey in figures the meaning of this proposal. The cost of the works for deep navigation in the Canadian section is estimated at \$86,000,000. About 3,000,000 horse-power can be developed at Soulanges and Lachine at a cost of \$296,000,000. Now then, the fixed charges on this capital expenditure of \$86,000,000 will amount to at least \$7,000,000. Spread over 3,000,000 horse-power this means that there must be added \$2.50 per horse-power to the sale price of the power. This is the minimum increase. But 3,000,000 horse-power can only be fully marketed after a long period of years. It is very likely that the improved navigation will have to be provided before the 3,000,000 horse-power can be marketed. It is even possible that the additional charge will have to be spread over 1,000,000 horse-power. In that case, \$7 per horse-power would have to be added to the normal selling price in order to cover the costs of navigation. Such a principle will never find acceptance in Ontario, and it is to be hoped that Quebec will not lend its support.

In conclusion: (1) The St. Lawrence can be improved for navigation alone at a cost of \$167,000,000 between Lake Ontario and Montreal, and at a cost of \$44,000,000 in the Great Lakes section, for navigation at 25 feet. This is the deep waterway project proper.

(2) The St. Lawrence can be improved for power alone, retaining the present canals, at a cost of about \$533,000,000—whether there be canalization or not, this water-power will be developed some day.

The two proposals are distinct.

(3) It is necessary that a uniform flow be maintained down the river, and every development scheme must be made to provide for the maintenance of this uniformity.

(4) We must scrutinize the plans which may be proposed with respect to the development of the International Section of the river, as well as the plans which may be proposed in regard to the control of the flow from the Great Lakes.

(5) The cost of canalization must be separated from that incidental to the hydro-electric development—improved navigation should be paid by the country at large and not by the consumers of power.

By Right Hon. Mr. Graham:

Q. You said that it was open navigation from Prescott west; well, is not that for large vessels? Is it not essential to spend considerable money between Kingston and Prescott if the large lake vessels are to use that waterway?—A. Yes, it requires a certain amount of money there to make navigation safe.

Q. Then might I ask this—it is not a serious matter, but I knew that had to be done. You are speaking of the frazil ice and the floods below Cornwall; now, as a matter of fact, is it not true that in a lesser degree this frazil ice is formed even as far west as above Aultsville or Morrisburg, and floods a good deal of land at times?—A. Well, when the ice jams in that section of the river, but normally it should not.

Q. The reason I ask you is that I have had to drive from Morrisburg east to the second concession on several occasions because the river road was flooded, owing to this ice jam; I suppose that was caused by the two rapids above.

By Hon. Mr. McLennan:

Q. Do you only get frazil ice where there is a rapid current?—A. Yes. If you reduce the current to such a point that the ice will form there will be no frazil in consequence.

Q. If there is no frazil ice, power could be developed underneath the coating of ice?—A. Yes, sir.

By Right Hon. Mr. Graham:

Q. Then there is this point; you said that the double stage would cost some \$34,000,000 more, but that the protection of the St. Lawrence River, particularly at Montreal and east, would be much greater, in fact almost perfect, if we had the double stage, and would be worth more than the \$34,000,000?—A. \$34,000,000 is a very small amount to ensure the greater safety of navigation in Montreal.

Q. Then I got you right?—A. Yes.

Q. Then I want to ask you this, to go on the record; does not the double stage, in addition to the \$34,000,000 additional cost, mean a certain loss of power as compared with the single stage development?—A. Oh, very little. It means a certain loss of power, 100,000 horse-power or so.

Q. A few moments ago you did not care to express an opinion as to the liability of ocean-going vessels going west of Montreal; but could I put the question this way—you have stated it very thoroughly—in your opinion would the development of the waterways west of Montreal be injurious to Montreal in any way?—A. I don't think so.

By Hon. Mr. Reid:

Q. Now I want to ask a question. Did I understand you right when you said that in either the two schemes or the one, the dam would be placed either at the foot or at the head of Barnhardt Island?—A. The single stage plan provides for the two alternatives. The dam may be built at the head of Barnhardt

Island across to the foot of Long Sault Island, then across the South Sault channel, with the power house at the foot of Barnhardt Island; or the dam may be built at the foot of Barnhardt Island with the power-house connected to it.

Q. And the power-house for the 2,200,000 horse-power would be on the American side of the International Boundary line as it now stands?—A. Yes, sir.

Q. And in that canal there would be two locks, then?—one or two locks?—A. There would be two locks.

Q. And that would be on the American side of the line?—A. Yes, sir.

Q. Then there would be those weirs, necessary to regulate the water so far as the protection of Montreal is concerned, on the American side also?—A. Yes, sir.

By Hon. Mr. McDougald:

Q. Just as a matter of information, in part of your speech you refer to the advisory board. I have the Gazette of June 4th, and I find the caption, "Deep Waterway Plan" outlined for Engineers. I take it that that was practically your same speech delivered to the engineers, to the men of the association, under whose auspices that trip was planned, showing how it was carried out. It was a trip from Montreal to Brockville and return, I understand, and that is the caption of the account of the trip?—A. That trip was organized by the Montreal branch of the Engineering Institute of Canada.

Q. Who is the president of that?—A. Mr. F. C. Laberge.

By Hon. Mr. L'Esperance:

Q. One of your colleagues?—A. He is an engineer in private practice in Montreal, and he is a member of the Quebec Public Service Commission, but he has no connection with me whatever.

By Hon. Mr. McDougald:

Q. Who is the president of the Canadian Board of Engineers? Is there not a Canadian Board, or is there just a Montreal branch?—A. You mean the Engineering Institute at large?

Q. Yes, of Canada?—A. This year, Mr. Julian C. Smith.

Q. Who is he?—A. He is the vice-president and manager of the Shawinigan Water and Power Company. I may say that I had nothing whatever to do with the organization of that trip. I was simply asked if I would go and accompany the engineers and explain the improvements which are designed to be carried out, as the boat was going along.

By Right Hon. Mr. Graham:

Q. I suppose your greatest regret is that you were not able to reach Brockville—A. We missed that very much, Senator, and in the next place, that we could not shoot the rapids from Coteau down.

By Hon. Mr. Reid:

Q. It has been stated here that the canal could be placed as well on the Canadian side at Barnhardt Island as on the American, at a cost of \$3,500,000 more; do you agree with that statement?—A. That is what the estimate was, yes, sir.

Q. You were agreed with the other members of the Commission?—A. I am fully in agreement with all the other members of the Board.

The CHAIRMAN: We thank you very much, Mr. Lefebvre.

The Committee adjourned.

APPENDICES

1. Memorandum by Messrs. D. W. McLachlan and G. A. Lindsay, in answer to a series of questions asked by the Honourable Messieurs Béique and Reid.
2. Petition from the Quebec Board of Trade, dated 16th May, 1928.
3. Resolution adopted by the Council of the Chamber of Commerce, District of Montreal, 9th May, 1928.
4. (a) Copy of communication (undated) submitted by the Honourable Mr. Casgrain;
- (b) Copy of a letter dated 14th May, 1928, submitting (a) to the Director, Dominion Water Power and Reclamation Service, Department of the Interior;
- (c) Reply of the Director, Dominion Water Power and Reclamation Service, dated 16th May, 1928;
- (d) Copy of letter, dated 14th May, 1928, submitting (a) to the Chief Hydraulic Engineer, Hydro-Electric Power Commission of Ontario;
- (e) Reply of the Chief Hydraulic Engineer, Hydro-Electric Commission of Ontario, dated 17th May, 1928.
5. Extracts from "Transportation Economics of the Great Lakes-St. Lawrence Ship Channel," by Alfred H. Ritter, Transportation and Port Specialist; published by Great Lakes-St. Lawrence Tidewater Association, November, 1925, (submitted by Hon. Mr. Béique).

APPENDIX No. 1

ANSWERS TO QUESTIONS OF THE SPECIAL COMMITTEE OF THE SENATE APPOINTED TO INQUIRE INTO THE DEVELOPMENT AND IMPROVEMENT OF THE ST. LAWRENCE RIVER.

Question No. 1.—A sketch showing the international line throughout the International boundary waters and the course of navigation channel or canal with distances covered by each section on one side or other of the international line, and names of principal localities.

Answer.—Table No. 1, attached hereto, shows the distances on the existing navigation course on either side of the International Boundary from Port Arthur to Montreal. A set of charts covering the territory from the head of Lake Superior to St. Regis on the St. Lawrence River, has been prepared showing the existing navigation course in relation to the International Boundary.

Question No. 2.—Memorandum stating and enumerating the nature of the works made for the purpose of improving navigation by Canada or by the U.S. and approximate cost thereof.

Answer.—The following tables, attached hereto, give the information asked for in this question:—

Table No. 2.—List of works executed by United States in St. Mary's River

Table No. 3.—List of works executed by United States in St. Clair River.

Table No. 4.—List of works executed by United States in Lake St. Clair.

Table No. 5.—List of works executed by United States in Detroit River.

Table No. 6.—List of works executed by Canada from Lake Superior to Gulf of St. Lawrence.

Table No. 7.—Capital Expenditures by Canada and United States on Existing Waterway from Lake Superior to the Gulf of St. Lawrence.

Question No. 3.—Memorandum showing advantages or disadvantages of maintaining the navigation channel in its present location in the projected development of the St. Lawrence or the possibility and practicability of a navigation channel on the Canadian side and approximate amount of expense involved therefor.

Answer.—The main advantage of maintaining the navigation channel in its present location in the projected development of the St. Lawrence is cost. It is possible to locate a channel on the Canadian side but such a channel would be greatly inferior from a navigation point of view, to the existing channel on account of curvature and length of restricted channel in the St. Mary's River.

The approximate cost of such a channel as compared with deepening the existing channel as recommended by the Joint Board of Engineers, is shown below, and the course of navigation is shown on the charts prepared to accompany this memorandum.

	25 ft. Channel	27 ft. Channel
Approximate Cost of Channel on Canadian Side, Lake Superior to Lake Erie.....	\$147,000,000	\$167,000,000
Cost of Deepening existing channel as recommended by Joint Board of Engineers.....	44,700,000	66,200,000

Questions Nos. 4 & 5:—4. Amount of expenditures on American channel (International Section) between Lake Ontario and Prescott necessary to make 25 foot channel.

5. Same on Canadian Side. (Explain no locks or canals in this section.)

Answer:

Channel	Lake Ontario to Union Park	Union Park to Prescott	Total
	\$	\$	\$
4. 25 ft. channel on United States side.....	460,000	9,540,000	10,000,000
5. 25 ft. channel on Canadian side.....	10,360,000	640,000	11,000,000
25 ft. channel as proposed by Joint Board of Engineers. Partly on U.S. side and partly on Canadian side.....	(U.S.) 460,000	(Can.) 640,000	1,100,000

The works in this section of the river consist in removing shoals and cutting back projecting points. There are no locks or canals in this section of the river.

Question No. 6:—Amount of expenditures on American side to make new channel (International Rapids Section) Prescott to Lake St. Francis.

Answer:—The estimated cost of a navigation channel entirely on the United States side throughout the International Rapids section is about \$100,000,000. The construction of such a canal would not include the development of any power, nor would it do anything to decrease the cost of any future power development.

In the Chrysler Island Scheme as presented by the Canadian Section of the Engineering Board, the purely navigation canals and the locks are placed on the United States' side but the navigation channel in the river reaches crosses and recrosses the International Boundary many times.

The estimated cost of this scheme is \$269,355,000 and includes the development of 2,200,000 Horse Power.

Question No. 7:—Amount of Expenditures on Canadian side to make channel (International Rapids Section) Prescott to Cornwall, or Lake St. Francis.

Answer:—The estimated cost of a navigation channel entirely on the Canadian side throughout the International Rapids Section is about \$101,000,000. The construction of such a canal would not include the development of any power, nor would it do anything to decrease the cost of any future power development. Navigation conditions through such a canal would be much inferior to those in the Crysler Island Scheme as proposed by the Canadian Section of the Joint Board of Engineers as there would be 45 miles of canal navigation compared to 9 miles in the Crysler Island Two Stage Project. There would be 13 bridges crossing the canal compared with one only in the Crysler Island Scheme.

The purely navigation canals and locks could be placed on the Canadian side in the Crysler Island Project at an additional cost of \$3,500,000, over and above that shown for these works on the United States side. If this were done, the total cost of the Crysler Island Project would be \$272,855,000 including the development of 2,200,000 horse power. The navigation channel in the river reaches however, would cross and recross the boundary many times.

G. A. LINDSAY,
D. W. McLACHLAN.

OTTAWA, ONTARIO, May 19, 1928.

TABLE No. 1

TABLE SHOWING LENGTH OF EXISTING NAVIGATION COURSES ON CANADIAN AND UNITED STATES SIDE OF INTERNATIONAL BOUNDARY—PORT ARTHUR TO MONTREAL. DOWNBOUND COURSE VIA CANADIAN SOO LOCK

Section	Lengths in Miles			
	On Can. Side	On U.S. Side	Along Boundary	Total
Lake Superior.....	29.00	217.00	12.00	258.00
St. Mary's River.....	6.40	53.60	3.60	63.60
Lake Huron.....		215.40		215.40
St. Clair River.....	0.60	15.30	26.10	42.00
Lake St. Clair.....		18.00		18.00
Detroit River.....	9.75	12.35	9.50	31.60
Lake Erie.....	198.00	21.00		219.00
Welland Canal.....	26.75			26.75
Lake Ontario to Tibbetts Point. (Opposite Kingston)	82.25	76.00		158.25
St. Lawrence River—				
Opposite Kingston to Brockville.....	9.30	42.74		52.04
Brockville to Prescott.....			12.00	12.00
Prescott to Head of Galops Canal.....	7.00			7.00
Galops Canal.....	7.30			7.30
Open River.....	4.50			4.50
Rapide Plat Canal.....	3.66			3.66
Open River.....	9.50			9.50
Farran's Point Canal.....	1.25			1.25
Open River.....	5.00			5.00
Cornwall Canal.....	11.25			11.25
Lake St. Francis.....	31.00			31.00
Soulanges Canal.....	14.00			14.00
Lake St. Louis.....	16.00			16.00
Machine Canal.....	8.50			8.50
Totals—Downbound Course via Canadian Soo Lock..	481.01	671.39	63.20	1,215.60
Totals—Upbound Course via Canadian Soo Lock....	488.26	660.99	67.45	1,216.70
Totals—Downbound Course via U.S. Soo Locks	477.31	674.49	63.20	1,215.00
Total—Upbound Course via U.S. Soo Locks.....	484.56	664.09	67.45	1,216.10

TABLE No. 2
LIST OF WORKS EXECUTED BY UNITED STATES IN ST. MARY'S RIVER
As Completed to June 30, 1927

Name of Improved Channel (1)	Distance from Soo Locks Miles (2)	Length Feet (3)	Used by up or down bound vessels (4)	Minimum Width Feet (5)	Depth Feet (6)	Remarks (7)
Round Isd. Shoal No. 1.....	8 M. above	2,300	Both	1,000	21	Partly on Canadian and partly on United States side of International Boundary. All on U. S. side of Boundary.
Round Isd. Shoal No. 2.....	8 M. above	2,200	Both	975	21	
Vidal Shoals.....	1.5 M. above	5,300	Both	1,000	21	
Soo Locks and Approaches—						
Weitzel Lock.....	at Soo	515	.....	60	12-6	Completed 1881
Poe Lock.....	"	800	.....	100	18	Completed 1896
Davis Lock.....	"	1,350	.....	88	24-5	Completed 1914
Fourth Lock.....	"	1,350	.....	80	24-5	Completed 1919 On U. S. side of Boundary.
Emergency Dams—						
South Canal.....	"	.....	.....	.....	.....	Completed 1911
North Canal.....	"	.....	.....	.....	.....	Completed 1922
Bayfield Shoal.....	1.5 M. below	6,000	Both	1,000	21	Small portion on Canadian side of Boundary.
Little Rapids Channel.....	4 M. below	31,400	Both	600	21	All on U. S. side of Boundary.
Nine Mile Point Shoal.....	10 M. below	2,100	Up	.....	21	All on U. S. side of Boundary.
Lower end Hay Lake.....	13 M. below	17,700	Up	300 (a)	21	All on U. S. side of Boundary.
Middle Neebish.....	16 M. below	10,000	Up	300 (a)	21	All on U. S. side of Boundary.
Little Mud Lake.....	20 M. below	24,100	Up	300 (a)	21	Lies along Boundary, part on Canadian and part on U. S. side.
Sailors' Encampment.....	23 M. below	5,300	Up	300 (a)	21	On U. S. side of Boundary.
Shoal 28, Mud Lake.....	25 M. below	7,500	Up	1,000	21	On U. S. side of Boundary.
West Neebish.....	15 M. below	64,800	Down	300	21	On U. S. side of Boundary.
Twin Isd. Shoal.....	30 M. below	.....	Both	.....	21	All on U. S. side of Boundary.
Point aux Frenes Shoal.....	31 M. below	.....	Both	.....	21	This work consisted of removing boulders, and projecting points only.
Squaw Isd. Shoal.....	42 M. below	.....	Both	.....	21	
Crab Isd. Shoal.....	47 M. below	.....	Both	.....	21	

NOTES—(a)—The United States Government has appropriated money to widen these channels to 500 feet.
The Depths noted are below Project Datum Plane. The actual minimum depth available was 19-6 feet in May, 1926.
Total expenditure by United States to June 30, 1927.

New work.....	\$26,413, 737 30
Maintenance.....	626, 753 20
Total.....	\$27,040, 490 50

TABLE No. 3.
LIST OF WORKS EXECUTED BY UNITED STATES IN ST. CLAIR RIVER.
As Completed to June 30th, 1927.

Name of Channel.	Distance from opposite Desmond Beach. Miles.	Length. Feet.	Used by Up or down bound vessels.	Minimum Width.		Depth. Feet.	Remarks.
				Feet.			
Foot of Lake Huron.....	1.5 M. Below.	13,500	Both.	2,400		22	On U. S. Side of Boundary.
Port Huron Shoal— East Channel.....	4.0 M. below.	(a)	Up.	1,400		20	Partly on Canadian Side.
West Channel.....	4.0 M. below.	7,000	Down.	1,100		21	On U. S. Side.
Stag Island— East Channel.....	10 M. below.	(a)	Up.	800		20	On Canadian side.
West Channel.....	10 M. below.	(a)	Down.	1,150		20	On U. S. Side.
Middle Ground.....	16	(a)	Both.	950		20	On U. S. Side.
Grand Point.....	33	(a)	Both.	1,000		20	On U. S. Side.
Squirrel Isd.....	34	(a)	Both.	650		20	On U. S. Side.
Arthur House.....	39.5	(a)	Both.	900		20	On U. S. Side.

Notes:—(a) Improvements consisted in the removal of obstructions or widening of channels.
The Depths noted are below Project Datum Plane. The actual minimum depth available was 19.6 feet in May, 1926.
Total Expenditure by United States to June 30, 1927.

New Work.....	\$ 833,140 08
Maintenance.....	406,282 29
Total.....	\$ 1,239,422 37

TABLE No. 4.
LIST OF WORKS EXECUTED BY UNITED STATES IN LAKE ST. CLAIR
As Completed to June 30, 1927.

Name of Channel.	Distance from Head of St. Clair Flats Canal. Miles.	Length. Feet.	Used by Up or down bound vessels.	Minimum Width. Feet.	Depth. Feet.	Remarks.
St. Clair Flats Canal.—						
East Channel.....	0-75	7,500	Up.	294	20	On U. S. Side of Boundary
West Channel.....	0-75	7,500	Down.	300	20	"
Channel lakeward of dikes.....	2-0	11,000	Both.	500	20	"
Grosse Pte. Channel.—						
Upper Portion.....	8	32,280	Both.	600	20	"
Lower Portion.....	12	27,720	Both.	800	21	"

Notes:—Total expenditure by United States, to June 30th, 1927.

New Work.....	\$ 2,370,483 03
Maintenance.....	619,854 99
Total.....	<u>\$ 2,990,338 02</u>

TABLE No. 5
LIST OF WORKS EXECUTED BY UNITED STATES IN DETROIT RIVER
As Completed to June 30th, 1927

Name of Channel	Distance from Windmill Point	Length	Used by up or down bound vessels	Minimum width	Depth	Remarks
	Miles	Feet		Feet	Feet	
Fighting Island.....	16 M. below	25,000	Both	800	21.8	On U.S. Side of Boundary.
Amherstburg.....		12,000	Up	600	21.8	About six-tenths on Canadian Side and
".....		46,000	Up	600	20.8	four-tenths on U.S. Side.
".....		11,000	Up	800	21.8	
Livingstone—						
Rock Section.....		31,500	Down	450	21.8	About eight-tenths on Can. Side and
Earth Section.....		26,500	Down	800	21.8	two-tenths on U.S. Side.
".....		8,000	Down	800	20.8	

NOTE.—Total Expenditure by United States to June 30th, 1927.

New Work.....	\$ 15,137,472 42
Maintenance.....	84,807 24
Total.....	<u>\$ 15,227,279 66</u>

TABLE No. 6

LIST OF WORKS EXECUTED BY CANADA ON THE EXISTING WATERWAY
Lake Superior to the Gulf of St. Lawrence

Name	Remarks
Sault Ste. Marie Canal and Lock....	Depth on Mitre Sill—18.2 ft. 1 Lock 900 ft. x 60 ft. Length of Canal—1.3 miles. Canal 141.67 feet wide at bottom.
Welland Canal.....	Depth of Water—14 ft. 26 Locks 270 ft. x 45 ft. Length of Canal 26.75 Miles.
North Channel.....	Channel above entrance to Galops Canal.
Galops Rapids Channel.....	In North Galops Rapids.
Galops Canal.....	Depth of Water—14 ft. 3 Locks. Guard Lock 270 ft. x 45 ft. Lift Lock at foot of canal 800 ft. x 50 ft. Lift Lock to pass vessels around Galops rapids only 303 ft. x 45 ft. Length of Canal 7.30 Miles. All ascending boats use this canal. Descending boats leave the canal at Lock No. 28 above Cardinal.
Rapide Plat Canal.....	Depth of Water—14 ft. 2 Locks 270 ft. x 45 ft. Length of Canal 3.66 Miles. All ascending boats use this canal. Descending boats pass through it only in extreme low water periods.
Farran's Point Canal.....	Depth of Water—14 ft. 1 Lock 800 ft. x 50 ft. Length of Canal 1.25 Miles. This canal is used by ascending boats only.
Cornwall Canal.....	Depth of Water—14 ft. 6 Locks 270 ft. x 45 ft. Length of Canal 11.25 Miles.
Lake St. Francis.....	Dredging at two points to give required depth.
Soulanges Canal.....	Depth of Water 15 ft. 5 Locks 280 ft. x 45 ft. Length of Canal 14.0 miles.
Lake St. Louis.....	Dredging at various points to give required depth.
Lachine Canal.....	Depth of water—14 ft. minimum. 5 Locks 270 ft. x 45 ft. Length of canal 8.5 miles.
St. Lawrence Ship Channel.....	Extends from Montreal to Goose Cape at "The Traverse," 60 miles below Quebec. Total length 230 miles. Minimum width of channel between Montreal and Quebec—450 ft. on tangents and 500 ft. to 800 ft. on curves. Below Quebec the minimum width is 1,000 ft. The 30 ft. channel is practically completed. There remains 38.18 miles to be dredged to obtain the 35 ft. depth throughout.

TABLE No. 7.

CAPITAL EXPENDITURE BY CANADA AND THE UNITED STATES ON EXISTING
WATERWAY FROM LAKE SUPERIOR TO THE GULF OF ST. LAWRENCE

By CANADA:—To March 31st, 1927—	
Sault Ste. Marie Canal.....	\$ 4,935,809 42
Welland Canal.....	29,906,411 93
St. Lawrence Canals and River—	
North Channel.....	1,995,142 87
River Reaches.....	483,830 20
Galops Channel.....	1,039,895 65
Williamsburg canals.....	1,334,551 80
Galops.....	6,143,468 11
Rapide Plat.....	2,159,880 80
Farran's Point.....	877,090 57
Cornwall Canal.....	7,245,804 21
Lake St. Francis.....	75,906 71
Soulanges Canal.....	7,904,044 53
Lake St. Louis.....	298,176 11
Lachine Canal.....	14,132,684 80
Total to Montreal.....	78,532,697 71
St. Lawrence Ship Channel.....	30,883,845 27
Grand Total.....	\$109,416,542 98
By UNITED STATES:—To June 30th, 1927.	
St. Mary's River.....	\$ 26,413,737 30
St. Clair River.....	833,140 08
Lake St. Clair.....	2,370,483 03
Detroit River.....	15,137,472 42
Total.....	\$ 44,754,832 83

APPENDIX No. 2

(Letterhead: The Quebec Board of Trade)

39 ST. PAUL ST.,

QUEBEC, Canada,

May 16, 1928.

To the Hon. CHAS. E. TANNER,

President of the Senate Committee on the St. Lawrence Waterway.

Hon. W. L. MACKENZIE KING, Prime Minister of Canada,

Hon. L. A. TASCHEREAU, Prime Minister of the Province of Quebec.

HONOURABLE SIRS,—The Council of the Quebec Board of Trade beg leave to petition you, in unanimous protest, against Governmental participation in consent unto or sanction of any project for the canalization or exploitation of the bed or waters of the St. Lawrence river, which may be designed in such manner as to have the effect of forcing any autonomous section of the people arbitrarily to contribute to the consummation of such project.

We are opposed to any International agreements, having in view the development or exploitation of what now constitutes a purely National possession, being convinced that any such arrangement must lead to concessions and sacrifice of inherited rights, which no established tribunal has any legal nor moral right to make, and which may easily be followed by embarrassments which we may be unable, in the future, to control.

We are in duty bound to object to any arrangement, national or international, that may endanger the regular flow of the water in the Channel of the St. Lawrence River at any point, at any time, nor can we consent to any experiment, within our boundaries or beyond them, which may adversely affect the permanent value of the water course, no matter how great the material, temporary or local, advantage may seem.

We regard the St. Lawrence River, at least that portion which flows entirely within the boundaries of Canada, as a heritage subject to a common International Law. (The Washington Treaty in 1871.)

We submit that it is not within the right of any generation to endanger the perpetuity nor prejudice the value of that inheritance, nor is it in the interest of the Canadian people to enter into any agreements or concessions with any foreign power in relation thereto. We strongly urge that all the dispositions of the St. Lawrence River, as lie within our territory, and such rights as may be ours beyond, and the control thereof, must be permanently conserved to the enjoyment of the people of Canada, present and to come.

We, therefore, most earnestly pray the Committee of the Senate of the Dominion of Canada, now in session upon this subject, the Prime Minister of the Dominion of Canada, and the Prime Minister of the Province of Quebec, to all of whom this petition is addressed, to give their high consideration to this plea of your most sincere petitioners, whose local interests are in no way endangered, but who are animated herein by a spirit of national interest and national pride.

Faithfully yours,

H. LOUDIN, *Secretary,*
Quebec Board of Trade.

APPENDIX No. 3

(Translation)

CHAMBER OF COMMERCE

DISTRICT OF MONTREAL

Resolution adopted by the Council of the Chamber of Commerce, on Wednesday, May 9, 1928.—Deepening and Damming the St. Lawrence River.

Considering Canada has every facility of transporting the wheat from the West since the 14 feet canals between the Great Lakes and Montreal have a capacity of 12 million tons per season. Last year traffic has been 7,000,000 tons, or 60 per cent of that capacity. The increase is slow and does not show that the full capacity can be attained before a certain number of years.

Considering it is not proven that the deep-draught ships (20 to 24 feet) navigating on the Great Lakes will go to Montreal if the project for canalization is carried out, owing to the nature of the freight to be transported. (Bulk freight).

Considering the anticipated reduction in the transportation rates between the Great Lakes and Montreal will not cover the additional interest and maintenance cost which the country will have to pay.

Considering that the finances of Canada do not justify the Government to assume such obligation which would delay the reduction of taxes so heavily weighing on the taxpayers.

Considering that the Chamber of Commerce of Montreal is strongly opposed to the principle that the national part of the river could be developed by private organizations able and desirous to finance the enterprise entirely, including the necessary canalization, in consideration of the right to use the electric power, because that course of action would be unfair to the consumer of the electricity so produced.

Therefore: In view of the reasons above mentioned, the Chamber of Commerce of the District of Montreal voices again its opposition to the digging and damming of the St. Lawrence River.

True Copy.

The Secretary,
J. C. GROVES-CONTANT.

APPENDIX No. 4 (a)

Senator J. P. B. CASGRAIN,
Montreal.

Dear SENATOR CASGRAIN:—I am sending you herewith a book called "Water Power Bonds" in which you will find a lot of statistics dealing with the investment per horse power, etc. In many cases the figure given as "funded debt per horse power" represents the cost of the different power plants. It is rather difficult to analyze these different figures, because one would have to know the details of the whole Company, but you will note that the Cedars Company is given as \$63 per horse power, which is probably a little low. The cost of the plant was perhaps \$75 per horse power.

Duke-Price original funded debt was \$33 a h.p., but after they reorganized the Company and changed the bond issue this was increased to about \$90 a h.p.

Laurentide Power Company is given as \$53 a h.p., which in view of later developments is probably a little low, and this might be put in as \$60 or \$70 a h.p.

On the other hand, the Manitoba Power Company which was put in at \$133 a h.p. has reduced this figure by the installation of added machinery so that its funded debt is down around \$100 a h.p.

The St. Maurice Power Company is in at \$71 a h.p., which is about correct.

The best estimate which we have been able to get on the St. Lawrence Waterways indicates that the cost of the power will, of course, depend whether the power plants bear the cost of navigation or not. If they do, the cost will run from \$175 to \$250 a h.p. The cost is going to depend in large measure upon whether the power is used promptly or whether the plants have to carry, as part of their capital cost, the burden for some years before the power is sold. In case the power cost \$200 a h.p. and the money is raised at 5 per cent, each year that the power is unsold will add \$10 a h.p. to the capital cost.

If there are any other figures or any explanations of the figures which are in the attached pamphlet which are not clear, I will be glad to be of any possible assistance.

There is no doubt but that these power developments are going to be more expensive than the average run of power developments which have been made or are being made at the present time.

APPENDIX No. 4 (b)

THE SENATE, CANADA,

OTTAWA, May 14, 1928.

J. T. JOHNSTON, Esq.,

Dominion Water Power Branch,

Department of the Interior, Ottawa, Ontario.

DEAR SIR:—As you may be aware, a Committee of the Senate is now engaged in making an enquiry into the St. Lawrence Waterways matters and the Committee may desire your assistance at some time. We have had Mr. McLachlan of the Engineering staff, and Dr. Skelton of the Department of External Affairs, and if time permits, other aspects may be enquired into.

In the meantime I am enclosing copy of a statement which Senator Casgrain has handed to me, and I would be very much obliged if you would go over it and let me have your observations in regard to the points raised in it. Possibly you may be able to do this immediately.

Our Committee may meet Wednesday, the 16th instant, and I might want to submit the matter to the Committee at that meeting.

Yours very truly,

CHAS. E. TANNER,

Enc.

Chairman of Committee.

APPENDIX No. 4 (c)

DEPARTMENT OF INTERIOR, CANADA

DOMINION WATER POWER AND RECLAMATION SERVICE

OTTAWA, ONT., May 16, 1928.

DEAR SIR,—I am in receipt of your letter of May 14th in which you point out that a committee of the Senate is now engaged in making an inquiry into the St. Lawrence waterway project and in this connection you ask my opinion with regard to a statement which Senator Casgrain has received and has handed you respecting costs of certain water-power developments.

In this connection Senator Casgrain's correspondent quotes the funded debt per horse-power of various hydro-electric developments and he also states that "it is rather difficult to analyze these different figures because one would

have to know the details of the whole company." The latter statement is quite true and it would be necessary to know the entire conditions both with regard to the capital actually expended in the construction of a plant and the conditions under which it operates, before making an intelligent estimate of the cost of power produced therefrom. With regard to the cost figures quoted for certain individual developments, I may say we have no information which would enable us to substantiate or alter these.

With regard to the average value per horse-power of plant and equipment in hydraulic central electric stations in Canada, I am attaching a copy of the Bureau of Statistics 1925 Report on Central Electric Stations, on page 18 of which you will find an analysis of the capital invested in the industry. Near the bottom of the page I have marked with a red arrow the figures which pertain to the average cost per horse-power of generation in hydraulic stations. You will note that for the whole Dominion this average figure was estimated to be \$117.00.

In regard to the foregoing, I may say that the financial figures for individual power producing organizations are furnished to the Bureau confidentially and consequently it is only possible to make public Provincial or Dominion totals and averages.

With regard to figures given as the cost per installed horse-power of hydraulic installation, I should point out that comparisons of such figures, one with another, cannot be intelligently made unless all conditions of load, water supply, etc., surrounding each development, are known and properly analyzed.

Turning to the part of the statement given to Senator Casgrain which deals with the estimated cost per horse-power of power developed in connection with the St. Lawrence waterway project, I may say that I have had no connection with the preparation of the cost estimates of this project but the Committee could probably secure full details from Mr. McLachlan of the Department of Railways and Canals, who was Chairman of the Canadian Section of the Joint Board of Engineers which investigated and reported upon the St. Lawrence waterway project.

Trusting that the foregoing will be found of assistance, I am,

Yours very truly,

J. T. JOHNSTON,
Director.

The Hon. CHARLES E. TANNER,
The Senate,
Parliament Buildings, Ottawa, Ont.

APPENDIX No. 4 (d)

OTTAWA, May 14, 1928.

Dr. THOMAS HOGG,
Ontario Hydro-Electric Commission,
Toronto, Ontario.

DEAR SIR,—As you may be aware, a Committee of the Senate is now engaged in making an enquiry into the St. Lawrence Waterways matters and the Committee may desire your assistance at some time. We have had Mr. McLachlan of the Engineering staff, and Dr. Skelton of the Department of External Affairs, and if time permits, other aspects may be enquired into.

In the meantime I am enclosing copy of a statement which Senator Casgrain has handed to me, and I would be very much obliged if you would go

over it and let me have your observations in regard to the points raised in it. Possibly you may be able to do this immediately.

Our Committee will be meeting this week, and possibly you might be able to let me have a statement at an early date so that I may submit it to the Committee.

Enc.

Yours very truly,

CHAS. E. TANNER,
Chairman of Committee.

APPENDIX No. 4 (e)

HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO

ENGINEERING DEPARTMENT

190 UNIVERSITY AVENUE,

TORONTO, 2, May 17, 1928.

Hon. C. E. TANNER,
The Senate,
Ottawa, Ont.

DEAR SIR,—I have the honour to acknowledge receipt of your letter of the 14th instant, with reference to your Committee of the Senate now engaged in making an enquiry into the St. Lawrence Waterway, and to the possibility of assistance from me with respect to this investigation.

I ought to point out that I am an employee of the Hydro-Electric Power Commission of Ontario, and, as this whole matter has been the subject of public discussion for some time and is one in which the province of Ontario and the Commission is vitally interested, I am sure you will understand that I could not accept the responsibility of appearing before your Committee without the consent of the Commissioners. I have not had the opportunity of discussing the matter with the Chairman, Mr. Magrath, as he is out of town for a few days; but I would venture to suggest, if your Committee should decide to ask the Commission's consent, that you communicate your request to him.

I have read the copy of the statement addressed to Senator Casgrain, attached to your letter. Although the figures given in the statement may, or may not, represent the total capital cost of the developments mentioned, this is only one of many factors entering into the consideration of the economics of the various projects. To estimate the economic value of any particular water power development, and to determine its ability to furnish power at competitive rates to the consumer, requires a great deal more information than is available in this statement and any observations I might make on the various points or conclusions of the statement might be very misleading to your Committee. I would not therefore feel justified in attempting further comment.

Yours respectfully,

T. H. HOGG,
Chief Hydraulic Engineer.

APPENDIX No. 5

Extracts from "Transportation Economics of the Great Lakes-St. Lawrence Ship Channel," by Alfred H. Ritter, Transportation and Port Specialist; published by Great Lakes-St. Lawrence Tidewater Association, November, 1925, (submitted by Hon. Mr. Béique).

INTRODUCTION

In 1920, Dr. R. S. MacElwee and the writer prepared a report on "The Economic Aspects of the Great Lake-St. Lawrence Ship Channel," which was submitted to the International Joint Commission and became part of the favourable report of that body in relation to this improvement. The original study was so broad in scope as to make it impracticable to present extensive data under every subject considered. The study involved especially the examination of the records of the many hearings held by the International Joint Commission, and the presentation of a concise recapitulation of the varied benefits to be expected from the improvement.

The need is now felt for a more complete exposition of the important transportation aspects, especially in view of the marked changes in ocean and rail rates and costs which have occurred since the original report was prepared, all of which affect, to some extent, the radius of the waterway's influence, and the savings to result from its use. The present supplemental report, which has been prepared to meet this need, is limited mainly to those aspects of the situation which have a bearing upon the utilization of the waterway by ocean vessels, the traffic available for movement, and the savings which will be made possible as a result of moving the sea base back to the shores of the Great Lakes.

Since the earlier report was prepared, a large amount of valuable information has become available. In accordance with instructions of Congress, an extensive investigation of American ports has been undertaken during the last few years by the Board of Engineers for Rivers and Harbours of the War Department, in co-operation with the United States Shipping Board, the results of which are appearing in some twenty-five volumes known as the Port Series. The writer has had immediate charge of the preparation of this series. In connection with this work, he has personally visited nearly all of the ports of the United States and has studied in detail the facilities available for traffic, the amount, nature, origin and destination of the business moving through our ports, and the suitability of the facilities and shipping services for serving adequately the local and interior hinterlands.

The War Department and the Shipping Board recently decided to supplement the Port Series by a study of the commerce and transportation facilities on the Great Lakes, the results of which will be published shortly. While that report is not concerned with the St. Lawrence development, some of the data obtained in its preparation are of value in considering this project. The writer was in personal charge of the preparation of this Great Lakes volume, and in connection therewith made a careful study of the facilities and the commerce of the American ports, and also the Canadian ports of Halifax, St. John, Quebec, Montreal, Prescott, Kingston, Toronto, the Georgian Bay ports, and the great grain port of Fort William-Port Arthur. Many of the grain elevators were inspected, records of performance secured, and the factors influencing the flow of grain studied. The St. Lawrence River has been inspected partly

from shore and partly by boat, for nearly its entire length between the Gulf of St. Lawrence and Lake Ontario. Through the courtesy of the Department of Railways and Canals, Department of Marine and Fisheries, Department of Trade and Commerce, Department of the Interior, the Board of Railway Commissioners, the Dominion Bureau of Statistics, the Board of Grain Commissioners for Canada, the Harbour Commissioners at Quebec, Montreal and Toronto, the municipal authorities and commercial bodies at other points, the executives of the Canadian National Railways, the Canadian Pacific Railway, and their agents at the various ports, a vast store of published and unpublished data has been secured.

The writer desires to emphasize that, while he occupies an official position in the War Department, the present volume is in no sense an expression of the views of that Department. The views of the War Department on matters treated in this report, so far as they have been formulated, appear in public documents. The Department is at present undertaking studies of certain waterways connecting with the Great Lakes. The writer has taken no part in these, and has no information as to what decisions will be made. He makes this statement in order that nothing in this report may be taken as anticipating or reflecting the conclusions of the War Department on these matters.

ALFRED H. RITTER.

June 1, 1925.

CONCLUSIONS

Briefly summarized, the study shows that the waterway as proposed will be thoroughly practicable for ocean vessels. The amount of restricted navigation will not be sufficient either to interfere with its use or to have any important effect upon rates. While a depth of 25 feet would serve to permit an important development of traffic, it is believed that a preliminary depth of at least 27 feet should be provided, and that a depth of 30 feet will be found most useful. A depth of 30 feet will meet all requirements of freight traffic. The large combination passenger and freight liners are not essential to the success of this route. There is a very large volume of traffic now moving between the territory to be served by this waterway and the seaboard, both in foreign and domestic trade. The greater proportion consists of commodities of a nature which will take advantage of reduced transportation costs. The interested traffic is found to be approximately 30,000,000 tons annually, but it is not possible to state just what part of this interested traffic will actually move over the waterway. The indicated savings are sufficient, however, to warrant the belief that a large part of it will be benefited, either directly, through the use of the waterway, or indirectly, through the influence which the waterway will exert on rates via competing routes. The probable transportation savings on grain alone are equal to interest at 5 per cent on \$800,000,000, while the annual transportation savings plus farm price enhancement are estimated to equal or exceed the total expense of the improvement properly chargeable to navigation, under the original project submitted to Congress by the International Joint Commission. The waterway will facilitate and encourage the development of the important agricultural and industrial territory tributary to the Great Lakes, and will stimulate the foreign and domestic trade of this region. In making possible more economical communication between this territory and points on and near the Atlantic, Gulf and Pacific coasts, it will benefit directly or indirectly the entire United States.

The St. Lawrence Ship Channel is not a rival to any inland waterway, constructed or proposed. It is an extension of existing ocean routes by means of which vessels from all parts of the world may reach the rich and populous territory bordering on the Great Lakes. It will establish a new and fourth seacoast, and a sea base from which tributary rail, water and highway routes will radiate. It is as essential to the people of the United States and Canada as are the Straits of Gibraltar to southern Europe, the Dardanelles and Bosphorus to the people of Russia and the Balkans, and the Baltic navigation to northern Europe. No logical plan to meet our future transportation requirements can fail to recognize its basic position. The project is not sectional in character, but is of outstanding national and international interest.

Statement re Value of the St. Lawrence Waterway as a Transportation route by Mr. D. W. McLachlan, Engineer in Charge, St. Lawrence Waterways, Department of Railways and Canals, Ottawa, Ontario, and Mr. G. A. Lindsay, Senior Office Engineer, St. Lawrence Waterways, Department of Railways and Canals, Ottawa, Ontario.

CONTENTS

PART "A"—VALUE TO CANADA

	PARA
Comparison of the proposed St. Lawrence Waterway with existing waterways.....	4
The proposed St. Lawrence Waterway.....	5
The Welland Ship Canal.....	6
The Manchester Ship Canal.....	7
The Amsterdam Canal.....	8
The Suez Canal.....	9
The Parana River.....	10
The Panama Canal.....	11
Other Routes.....	12
Effect of Locks.....	14
Transportation Costs.....	17
Ship Costs.....	18
Cost of Transporting Grain.....	20
Transporting Package Freight.....	22
Summary	28
Volume of Canadian Traffic and Annual Savings in Transportation Costs.....	30
Grain	32
Exports to China and Japan.....	37
Flour	48
Lumber	50
Coal	53
Other Commodities.....	55
Summary	57
Draught	59
Return Cargoes.....	67

PART "B"—VALUE TO THE UNITED STATES

Estimate of Potential Traffic.....	73
Transportation Costs on Grain.....	75
Lumber	78
Iron Ore.....	81
Package Freight.....	85
Summary	87

PART "C"—ANNUAL CHARGES AND BENEFITS FROM ST. LAWRENCE WATERWAY PROJECT

Summary.....	PARA. 90
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TABLES

Table 1	Length of various routes in statute miles.....	PAGE 314
" 2	Characteristics and performance of ships.....	314
" 3	Summary showing time of navigation of waterways in days.....	315
" 4	Statement showing time of navigation of waterways.....	315
" 5	Cost of elevator operation transferring 33,000,000 bushels per year from one ship to another.....	317
" 6	Insurance and pilotage rates—various ships.....	318
" 7-13.	Cost of transportation of grain—various routes.....	318-321
" 14	Cost of transferring package freight from car to ship at Montreal.....	322
" 15	Cost of transferring bagged commodities from canal boat to vessel at Montreal.....	322
" 16	Cost of transferring bagged commodities from rail to ship or ship to rail at Fort William or Port McNicholl.....	322
" 17	Tonnage through Canadian and American canals at Sault Ste. Marie.....	322
" 18	Traffic through Welland Canal.....	323
" 19	Traffic on St. Lawrence Canals.....	323
" 20	Lake and rail shipments of wheat, wheat flour, and other grain from head of Lakes.....	323
" 21	Canadian wheat and other grain from head of lakes passing through Sault Ste. Marie canals by points of destination.....	324
" 22	Canadian flour from head of Lakes passing through Sault Ste. Marie canals by points of destination.....	324
" 23	Exports of Canadian grain and wheat flour from U.S. north Atlantic ports, Montreal and Quebec, in 5 and 7 months periods.....	325
" 23a	Exports of American grain from U.S. North Atlantic ports, Montreal and Quebec, in five and seven months periods.....	326
" 24	Exports of Canadian wheat and other grains overseas by routes.....	327
" 25	Exports of Canadian wheat, wheat flour, and other grains by countries and destinations.....	328
" 26	Production and export of wheat from Canada and United States.....	328
" 27	Average production of wheat per capita and exports of wheat and wheat flour per capita of the United States for ten year periods from 1870 to date.....	329
" 28	Average production of wheat per capita and average exports of wheat and wheat flour of Canada per ten year periods from 1871 to date.....	329
" 29	Average production and exports per capita of grain other than wheat of Canada for ten year periods from 1871 to date.....	329
" 30	Traffic through Manchester, Suez, and Panama Canals.....	329
" 31-35.	Cost of transportation of grain from Edmonton to Liverpool by various routes.....	330-331
" 36	Dimensions of standard cargo ships as determined from averages of those listed in recent years.....	331
" 37	Estimated carrying capacity of ships built in 12 leading countries of the world and still afloat in 1913-1923 and 1924.....	332
" 38	Potential study of U.S. exports.....	333
" 39	Potential study of U.S. Imports.....	333
" 40	Annual shipments of grain on the Great Lakes.....	333
" 41	Annual shipments of grain on the Great Lakes, by ports.....	334
" 42	Annual shipments of grain on the Great Lakes, by kinds.....	334
" 43A	Grain receipts at Montreal, 1923.....	334
" B	Grain receipts at Montreal, 1924.....	335
" C	Grain receipts at Montreal, 1925.....	335
" D	Grain receipts at Montreal, 1926.....	335
" 44	Grain and flour exports from Canada and United States, 1908-1926.....	336
" 45	Monthly movement of iron ore on the Great Lakes.....	336
" 46	Monthly movement of soft coal on the Great Lakes.....	336
" 47	Comparison of freight handled by Canadian Steam Railways with freight handled on St. Lawrence Canals.....	337
" 48	Annual charges and benefits from Deep Waterway Project.....	337
" 49	Annual charges and benefits from Navigation Works only.....	338

VALUE OF THE ST. LAWRENCE WATERWAY PROJECT AS A TRANSPORTATION ROUTE

PART "A"—VALUE TO CANADA

1 In order to estimate the transportation value to Canada of the St. Lawrence Waterway Project, it is necessary to determine savings to be made in comparison with other routes as well as estimate the volume of traffic offering. It is probable that the Welland Ship Canal will be completed and a transfer terminal, either at Gananoque or at Prescott, will be built and in use before the deep waterway project can be begun, and, therefore, estimates of savings must be based on the use of such terminals rather than on those now in use at Port Colborne, Buffalo, and Georgian Bay.

2. With the above works completed, the Great Lakes freighter will take grain and other goods from the head of the Lakes to either Gananoque or Prescott, and there a transfer will be made to the present 2,400-ton canal boat. This boat will then continue via the present 14-foot canal system to Montreal, where a transfer to an ocean ship will be made.

3. After the St. Lawrence Waterway is built, the ocean tramp will be able to proceed directly to the head of the Lakes, or the Great Lakes freighter and the ocean boat can meet at some intermediate point such as Gananoque, Prescott, Montreal, or Quebec. In this way one transfer can be avoided and a more economic movement of vessels secured.

COMPARISON OF THE PROPOSED ST. LAWRENCE WATERWAY WITH EXISTING WATERWAYS

4. The question of whether or not ocean carriers will enter the proposed St. Lawrence Waterway has been much discussed. No waterway exists that can be compared with this route in all respects. Some authorities hold there are too many locks and restrictions on the St. Lawrence Waterway Project to admit general use by ocean shipping.

5. *The Proposed St. Lawrence Waterway.*—If built along the lines recommended by the Canadian Section of the Joint Board of Engineers in their report of November, 1926, the St. Lawrence Waterway will have nine locks between Montreal and Lake Ontario. The locks will be 859 feet long between inner quoin posts, and 80 feet wide, with a depth of water of 30 feet on the sills. The total distance from Montreal to Lake Ontario is 183 miles. The clear width of the channel provided will be as follows:—

12½ miles—200 feet wide)	Canal and lock approaches.
10 miles—300 feet wide)	
10½ miles—450 feet wide)	
6 miles—550 feet wide)	Subaqueous channels.
4 miles—600 feet wide)	
140 miles—wider than 600 feet.	

6. The Welland Ship Canal will be 26 miles long with eight locks of the same dimensions as shown above. The minimum width of the canal prism is 200 feet.

7. *The Manchester Ship Canal.*—The Manchester Ship Canal (see Vol. 2, Lloyd's Register, 1927-28), connecting Manchester with the River Mersey near Liverpool, is 35½ miles long, 28 feet deep, and has a minimum width of 120 feet.

except for $\frac{3}{4}$ miles near Latchford, where it is only 90 feet wide. A difference in level of 70 feet is overcome by five locks, 600 feet long by 65 feet wide. The radius of curvature provided on the proposed St. Lawrence Waterway is about 50 per cent greater than that in use on this canal. The traffic through this canal in 1925 was 5,881,691 tons (see Table No. 30), and the rail haul saved is only 35 miles.

8. *The Amsterdam Canal.*—The Amsterdam Canal (see Vol. 2, Lloyd's Register, 1927-28), connecting the North Sea at Ymuiden with Amsterdam and Zuider Zee, is 17.4 miles long, 165 feet wide, with a depth of 32 feet. There is one lock 722 feet long by 82 feet wide. This canal is used extensively. It places Amsterdam on a competitive basis with Rotterdam.

9. *The Suez Canal.*—The Suez Canal (see Vol. 2, Lloyd's Register, 1927-28) is 36 feet deep, but for 53 miles is 50 feet narrower than the narrowest part of the proposed St. Lawrence Waterway. The traffic through this canal is shown on Table No. 30.

10. *The Parana River.*—The ports of Rosario and San Lorenzo on the Upper Parana River are 245 miles above Buenos Aires by water, and only 188 miles above it by rail. The depth of the river is 22 to 25 feet, depending upon the season of the year. The channel is very sinuous and there are many sharp curves. The grain exports from these ports in 1924 amounted to 3,942,000 tons.* About 50 per cent of the cereal exports of the Argentine Republic were shipped from these ports in 1924.

11. *The Panama Canal.*—The Panama Canal (see Annual Report of Panama Canal) is about fifty miles long from deep water in the Atlantic to deep water in the Pacific. Its length from ocean to ocean is about forty miles. There are six double locks, each with usable length of 1,000 feet, usable width of 110 feet, and depth of 41 feet on the sills. The width of the canal prism is 300 feet for a length of eight miles. The tonnage through the Panama Canal since 1916 is shown in Table No. 30.

12. *Other Routes.* There are great lengths of restricted water on many routes now used by ships of commerce. A boat plying between Hamburg and any Chinese or Asiatic port passes through as great a length of artificial channel as there will be between Liverpool and Fort William via the proposed waterway.

13. The bends on many important channels are sharper than on the proposed route. On the channel leading to the important port of Antwerp there is one curve which is twice as sharp as any curve on the St. Lawrence Waterway where the standard radius of curvature is 5,000 feet.

14. *Effect of Locks.*—The use of locks in waterways delays the passage of boats, but they cannot be regarded as a serious hindrance when it is considered that at the present time, all boats travelling between Fort William and Montreal pass through 48 locks, nearly all of which are the same length as that of the ships using them. The tonnage passing through these canals has increased in the past few years to such an extent that their capacity, as limited at Cornwall, is now practically reached. During the past season, there were many periods of congestion which extended over two or three days. The growth of traffic on the St. Lawrence Canals as compared to the growth of traffic on the Canadian Railways since 1902, is shown on Table No. 47. The total freight handled on the St. Lawrence Canals since 1902 has increased 623 per cent while the total freight handled by Canadian Steam Railways in the same period has increased only 188 per cent.

* U.S. Dept. of Commerce Report, Vol. 35, August, 1925, Page 537.

It is clear that a few spacious locks will not be a barrier to growth of traffic on a waterway, when over 85,000,000 tons of freight are carried through the five locks at Sault Ste. Marie each year. The annual traffic through the Sault Ste. Marie, Welland, and St. Lawrence Canals, is shown on Tables 17 to 19 attached.

15. All ships must pass through entry locks to reach the loading wharves of London, Liverpool, Manchester, Avonmouth, Cardiff, Swansea, and Amsterdam, and locks are also required to reach some sections of the ports of New Orleans, Seattle, Quebec, Havre, Dunkirk, Calcutta, Singapore, Melbourne and Buenos Aires.

16. There is usually a slightly higher rate of insurance on goods shipped from Montreal to Manchester, than to Liverpool. When the cargo is grain, or other commodity which has a value of about \$50 per ton, the extra rate of insurance is about four cents per ton. This is equivalent to less than one cent per lock passed through.

TRANSPORTATION COSTS

17. In arriving at the cost of transportation by the various routes considered, a careful study was made of all information available in regard to the actual costs and performances of different classes of ships, as well as data on insurance, transfer charges, etc. The speed of ships in restricted canals was taken at four miles per hour with a ratio of ship to canal section of 1 to 3·3 and five miles per hour with a ratio of 1 to 5·05. The result of this investigation is shown in the following attached tables:

No. 1. Length and character of navigation by various routes. (Statute Miles.)

2. Characteristics and performance of ships.
3. Time of navigation of various routes. Summary.
4. Time of navigation of various routes. Details.
5. Cost of transferring grain at typical elevator. (Port Colborne.)
6. Insurance and Pilotage rates by various routes.
7. 13. Cost of transporting grain by various routes.

18. *Ship Costs*.—The relative cost of building and operating ocean tramp ships, canal sized ships, and bulk lake freighters, was investigated. Information on costs was obtained from various shipbuilding concerns in Canada, the United States, and the United Kingdom, as well as maintenance and operating costs from shipping companies such as the Canada Steamships Company and the Canadian Government Merchant Marine. This detailed information is on file in the Department of Railways and Canals.

It was found that the cost of the tramp, as built in English shipyards, in 1913, varied from \$32 to \$35 per ton. It was found that the cost of the bulk lake freighter, built in the Great Lake yards, in 1913, was \$37 to \$41 per ton deadweight carrying capacity. What the relative cost of the two types would be, if built in the same yards, could not be determined. As the present cost of building ships is 60 per cent above pre-war costs, the values used in determining the costs of transportation by the various routes were as follows:—

Ship	Deadweight carrying capacity	Cost per ton
	tons	\$ e.
Canal size.....	2,400	79 00
Ocean tramp.....	8,500	56 50
Lake freighter.....	12,000	62 50

19. A difference between the ocean tramp and the bulk lake freighter should be noted. A lake freighter, when carrying grain on the Great Lakes, requires no special bulkheads or fittings to keep the cargo from shifting, while the tramp ship, when hauling such cargoes across the ocean, requires a longitudinal division wall of two inch plank. If the journey inward from Liverpool to Montreal is made in ballast, the crew often erect these fittings at sea, but if a cargo is carried, they must be placed after such cargo is unloaded. This causes delay in port.

20. *Cost of Transporting Grain.*—The estimated cost of transporting grain by various selected routes, from Fort William to Liverpool, is shown below. It is worked out by assuming long tons and no return cargoes. Reference to Table No. 2, showing the characteristics and performance of ships, will show that the fixed charges, such as interest, depreciation, maintenance, and repairs, are taken at 13 per cent per annum, and, in the case of the canal size ship and the bulk lake freighter, are spread over a period of $7\frac{1}{2}$ months only, while, in the case of the ocean tramp, an operating period of 11 months is taken.

Route	Table No.	May 1 to Sept. 31	Oct. 1 to Oct. 31	Nov. 1 to Nov. 25
		\$ c.	\$ c.	\$ c.
<i>Via existing routes—</i>				
All water, transfer at Port Colborne and Montreal.	7	5 87	5 95	6 13
Water and rail, transfer at Port McNicoll and Montreal.....	8	6 41	6 50	6 67
Water and rail, transfer at Buffalo and New York.	9	6 05	6 08	6 10
<i>With Welland ship canal—</i>				
All water, transfer at Gananoque and Montreal..	10	5 66	5 23	5 91
All water, transfer at Prescott and Montreal.....	11	5 67	5 74	5 93
<i>With Welland ship canal, St. Lawrence deep waterway—</i>				
All water, no transfer.....	12	3 95	4 03	4 21
All water, transfer at Montreal.....	13	4 59	4 66	4 83

The above table shows through shipments from Fort William to Liverpool will effect a saving of \$1.92 over the cheapest existing route, and \$1.71 over the cheapest method on completion of the Welland Ship Canal. In the following analysis a saving of \$1.50 per ton has been taken. This is equivalent to about 4 cents per bushel.

21. An analysis was made of the cost of transportation of grain, assuming the Welland Ship Canal built and the upper part of the Crysler Island Project executed, without any other improvements being made in the St. Lawrence river for navigation.

At the present time the canal size boat is highly powered in order to pass through the swift flowing portions of the river such as at Point Three Points, and north of Goose Neck Island. With a dam placed at Crysler Island, comparatively slack water would be available throughout the river. This would mean that the high powered boats could be replaced by boats with lighter engines, resulting in a saving in transportation costs. This saving is estimated to be 14 cents per ton compared with the cost of transportation with the Welland Ship Canal built and using the existing St. Lawrence canals.

22. *Transporting Package Freight.*—The elements entering into the cost of transporting package freight were investigated. Transportation costs from Fort William to Montreal by various ships exclusive of transshipping charges and assuming no return cargoes are based on an approximate rule which assumes a certain rate per 100-ton miles plus a turn around cost. The mileage from Fort William to Montreal was reduced to a common basis. Lockages, canals, and restricted channels were compensated for, at an assumed rate of 10 miles per hour.

The cost of transportation per ton by various ships is approximately as shown in the following tables:—

Class of ship	Distance Ft. William to Montreal	Rate per 100 ton miles	Turn around cost	Cost per ton
				\$ c.
Canal sized boat.....	1,370	15c.	38c.	2 43
Ocean tramp ship.....	1,340	8c.	28c.	1 35
Great lakes freighter.....	1,340	8c.	28c.	1 35

The costs per ton as figured on the basis of actual costs of ship operation are as follows:—

Canal sized boat, \$2.19 per ton.

Ocean tramp ship, \$1.22 per ton.

Great Lakes freighter, \$1.31 per ton.

The difference in cost per ton shown in the above two tables is accounted for by the fact that one has been figured, as stated, on the actual out-of-pocket cost of operation while the other was obtained by charting existing rates and assuming an average, so that one is on a cost basis and the other is, more or less, on a rate basis.

23. The elements entering into the cost of transshipping package freight were investigated. The result is shown in Tables Nos. 14-16 inclusive. A summary of these tables shows that

- The cost of transferring package freight from railway cars to ships at Montreal (Table No. 14) is about \$1.67.
- The cost of transferring bagged commodities such as flour or cement from canal boat to ocean vessel at Montreal (Table No. 15) is about \$1.74.
- The cost of transferring flour from rail to ship or ship to rail as at Fort William or Port McNicoll (Table No. 16) is about \$1.39.

24. The use of the above figures indicates that the saving in cost of transportation of bagged commodities that will be effected by the enlargement of the St. Lawrence and Welland Canals will be about \$1.74 per ton, on account of the elimination of one transfer, and \$1.08 per ton, on account of the cheaper transportation afforded by larger ships than these now in use on the present St. Lawrence Canals. This makes a total saving of \$2.82 per ton on package freight.

25. As the transportation capacity of the existing railways from Fort William to Montreal is greatly in excess of the volume of package freight offering at the present time, the effect of the diversion of package freight from these railways must be considered. The loss of railway profit on prospective business can be neglected, as the public pay it, but the saving in out-of-pocket costs of railway transportation exclusive of profit and fixed maintenance charges is important and should be determined. The difference between this and the cheaper water transportation represents the saving that can be made.

26. A study of railway returns indicates out-of-pocket costs to be about 4.8 mills per ton mile plus 40 cents terminal charges for through freight between Fort William and Montreal. As the average distance between Fort William and Montreal by the two railways is approximately 1,000 miles, this means an actual saving of \$5.20 per ton. From this must be deducted the estimated cost of ship transportation amounting to \$1.35 per ton (see Par. 22.) This leaves a net saving of \$3.85 per ton on package freight imported by, or exported from Western Canada from or to European or other Eastern countries.

27. Since there is some flour for export shipped through Port McNicoll to Montreal, the saving by comparison with this route should also be examined. The saving of 4.8 mills per ton mile noted in par. 26 applied to the rail haul between Port McNicoll and Montreal of 373 miles gives a total cost of \$1.80 per ton for rail transportation. The elimination of this rail haul together with two transfers, one at Port McNicoll amounting to \$1.39 (Par. 23c) and one at Montreal amounting to \$1.74 (Par. 23b) means a saving of \$4.93. Deducting from this the estimated cost of transport via the proposed waterway amounting to \$1.35 per ton, leaves a net saving on this class of business of \$3.58 per ton.

28. *Summary.*—The conclusions reached in the preceding paragraphs can be summarized as follows:—

- (a) The saving effected in transportation costs on grain, by the proposed waterway, will be about \$1.70 per ton. A saving of \$1.50 is taken in the following analysis.
- (b) The saving effected in the cost of moving package freight between Montreal and the head of the Lakes will be about \$2.80 per ton derived from a comparison of the cost of operation of the canal sized ship, and the ocean tramp. The saving on this class of goods would be about \$3.85 based on a comparison with the present cost of rail haul between Montreal and Fort William, including the existing transfer at Montreal.
- (c) The saving effected in the cost of transporting bagged flour in comparison with the existing route via Port McNicoll and rail to Montreal, will be about \$3.60 per ton.

29. The above figures will be used later in estimating the annual saving in transportation costs.

VOLUME OF CANADIAN TRAFFIC AND ANNUAL SAVING IN TRANSPORTATION COSTS

30. The volume of Canadian Traffic offering for transportation by a deep waterway from the Great Lakes to the Sea, cannot be estimated closely. A survey of water borne commerce throughout the world generally, shows that a special distribution of ore and coal deposits, oil fields, forests, etc., sometimes accounts for a huge interchange between manufacturing, agricultural and mining districts and such traffic often develops where least expected.

31. The traffic through the proposed waterway will be of two kinds, bulk cargoes, and package freight. Canada's portion of the former will be mostly grain.

32. *Grain.*—In order to get some idea of the volume and movement of grain through and from Canada, from which to base an estimate of the amount that might be attracted to the St. Lawrence route, the following tables have been prepared:—

Table 17.—Traffic through the Canadian and American Sault Ste. Marie Canals.

Table 18.—Traffic through the Welland Canal.

Table 19.—Summary of traffic through the St. Lawrence Canals.

Table 20.—Lake and rail shipments of wheat, wheat flour, and other grain from head of lakes.

Table 21.—Canadian wheat and other grains from head of lakes passing through Sault Ste. Marie Canals by point of destination.

Table 22.—Canadian flour from head of Lakes passing through Sault Ste. Marie Canals by point of destination.

Table 23.—Exports of Canadian grain and wheat flour from U.S. northern Atlantic ports, Montreal and Quebec, in five months and seven months periods.

Table 23A.—Exports of United States grain from U.S. northern Atlantic ports, Montreal and Quebec, in five months and seven months periods.

Table 24.—Exports of Canadian wheat and other grain overseas by routes.

Table 25.—Exports of Canadian wheat, wheat flour and other grains by countries of destination.

Table 26.—Production and exports of wheat from Canada and United States.

Table 27.—Average production of wheat per capita and average exports of wheat and wheat flour per capita of the United States for ten-year periods 1870 to date.

Table 28.—Average production of wheat per capita and average exports of wheat and wheat flour per capita of Canada for ten-year periods, 1870 to date.

Table 29.—Average production and exports per capita of grain other than wheat, of Canada for ten-year periods, 1871 to date.

Table 40.—Annual shipments of grain on the Great Lakes.

Table 41.—Annual shipments of grain on the Great Lakes, by ports.

Table 42.—Annual shipments of grain on the Great Lakes, by kinds.

Table 43.—

(a) Grain Receipts at Montreal, 1923.

(b) Grain Receipts at Montreal, 1924.

(c) Grain Receipts at Montreal, 1925.

(d) Grain Receipts at Montreal, 1926.

Table 44.—Grain and flour exports from Canada and United States, 1908-1926.

Table 45.—Monthly movement of iron ore on the Great Lakes.

Table 46.—Monthly movement of soft coal on the Great Lakes.

Table 47.—Comparison of Freight handled by Canadian Steam Railways with freight handled on St. Lawrence Canals.

33. The production and exports of Canadian wheat are now very large and increasing rapidly. Based on ten-year averages, the production per capita has increased from 7.5 bushels in 1881 to 38.2 bushels in 1921. The exports have increased during the same period from 0.75 bushels to 22.24 bushels. (See Tables Nos. 26 and 29.) The figures as regards grains other than wheat are:—production 27.1 bushels to 68.5 bushels; exports 2.5 bushels to 5.7 bushels. (See Table No. 29.)

34. The exports of wheat, wheat flour and other grains by countries of destination are shown on Table No. 25. The movement according to routes is shown on Table No. 24.

35. An examination of these tables will show that most of these exports are to the United Kingdom and countries other than the United States. Whether this movement will continue and increase, is the question to determine.

36. There is no sign yet that Canadian wheat will be required in the United States in other than small quantities. The production and exports per capita of that country have been fairly constant since 1880. (See Tables Nos. 26 and 27.) It is not so easy to prophesy the trend of exportation of grains other than wheat from the United States. The percentage of production that is exported has decreased since 1905 from 5 per cent to 3.3 per cent but the exports per capita have been fairly constant.

37. *Exports to China and Japan.*—Table No. 25 shows that the exports of wheat and wheat flour to China and Japan were 26,383,000 bushels in 1925-26. In 1923-24, they were 18,233,000 bushels, but in the intermediate year 1924-25 they were only 3,926,000 bushels. Whether these countries will continue to import wheat and flour from the North American continent, or not, is a question

that is inextricably interwoven with the problem of economic transportation within China itself.

38. The growing of wheat in Manchuria is an industry that is developing fast and wheat can be produced in China at one-third the cost of production in this country. At the present time, due to existing conditions in China, the transportation rates from the wheat growing portions of the country to the mills at Hankow are such that it is cheaper to import from Canada and the United States. The reason for the high imports into China and Japan during the years 1922 and 1923 was the poor crops in China. Prices abroad dropped, and silver exchange favoured imports. During these years, China also imported wheat from the United States and Australia. China in 1919, 1920, and 1921, exported wheat to Port Said and Great Britain.

39. To quote from a book entitled "China"—Trade Promotion Series—No. 38, published by the Bureau of Foreign and Domestic Commerce, Department of Commerce, U.S.A., 1926: "It may be that China will never become a substantial exporter of wheat or flour, although it is quite likely that with a shortage of wheat production in the world generally, China may be a helpful source of supply." From this, it may be inferred that, in the opinion of this authority, China will not become an importer of wheat. Also, with cheaper transportation for Canadian and United States wheat provided to Europe, via the St. Lawrence, if China's need for wheat should arise, then Australia might very well become the main source of supply.

40. Australia has always been the source of supply for the greater amount of wheat imported by Japan. A sample shipment of Siberian wheat was made recently to Yokohama and the importers believe that because of its low landed cost, this may be a forerunner of an increased importation of Russian wheat. Cheaper transportation costs via the St. Lawrence would also influence materially the export of Canadian wheat to Japan.

41. A further inspection of Table No. 24 will show a decided increase in the quantity of wheat exported via the Pacific coast. With the exception of the amount that goes to the Orient, practically all the balance goes through the Panama canal to the United Kingdom and Europe. Whether this movement will continue or not depends on transportation costs.

42. In order to show the cost of transporting grain from Edmonton to Liverpool via existing and proposed routes. Tables Nos. 31 to 35 have been prepared. An inspection of these tables will show:—

- (a) Cost of transporting grain from Edmonton to Liverpool via Vancouver and Panama canal (Table No. 31), \$11.39.
- (b) Cost of transporting grain from Edmonton to Liverpool via Fort William and existing canals (Table No. 32), \$12.55.
- (c) Cost of transporting grain from Edmonton to Liverpool via Fort William assuming Welland Ship Canal built with transfer at Gananoque (Table No. 33), \$12.34.
- (d) Cost of transporting grain from Edmonton to Liverpool via Fort William assuming Welland Ship Canal and St. Lawrence Waterway built and ocean tramp from Fort William to Liverpool (Table No. 34), \$10.63.
- (e) Cost of transporting grain from Edmonton to Liverpool—Great Lake freighter Fort William to Montreal with transfer at Montreal to ocean tramp (Table No. 35), \$11.27.

43. This shows that at the present time there is a saving of \$1.16 per ton by the Pacific route over the cheapest existing route via the present canal system. On the completion of the Welland Ship Canal and the St. Lawrence Waterway, however, the route via ocean tramp from Fort William to Liverpool will effect a saving of \$0.76 per ton over the Pacific route.

44. From the above, it might be safe to assume that after the completion of the waterway, some of the grain moving to the United Kingdom and Europe via the Pacific may be diverted eastward down the St. Lawrence.

45. The movement of Canadian wheat and other grains from the West for export during the past few years is shown in the attached tables. The portion of this that will be attracted to the St. Lawrence Waterway is hard to estimate. Table No. 23 shows the export of Canadian grain from the United States North Atlantic ports, Montreal, and Quebec, during the seven months of the navigation season since 1921. This has averaged about 142,000,000 bushels during the past four years. United States grains exported through the same ports and during the same period is approximately 100,000,000 bushels (see Table No. 23a). Since this portion of the study is purely Canadian, the United States export of grain is merely mentioned by way of comparison with Canadian exports. Based on the average distribution of the various kinds of grain during this period, Canadian grain amounts to approximately 4,000,000 tons. How much of this would be attracted to the waterway depends on various factors such as the extent to which the eastern railways will reduce rates in order to retain traffic, and how far the liners operating out of United States Atlantic ports will reduce rates so as to secure grain, which they need for deadweight. A lower export rate on grain from New York in the past has balanced 57 miles of shorter rail haul to Montreal, as well as the fact that two transfers are necessary at New York compared to one at the latter port. It will be quite ineffective, however, in balancing the elimination of 432 miles of rail haul and two transfers which will be brought about by the completion of the St. Lawrence Deep Waterway.

46. A fair estimate of the volume of Canadian grain that will be available for export via the St. Lawrence route is 4,000,000 tons per year. This is the amount now moving out via Montreal, Quebec, and United States North Atlantic ports. What the growth in Canada's grain export business will be, cannot be prophesied.

47. The total annual saving effected in the cost of exporting 4,000,000 tons of grain by the construction of the St. Lawrence Deep Waterway, at \$1.50 per ton (see Par. 28a) will be \$6,000,000.

48. *Flour.*—At the present time there is a large movement of flour from the west via Lake to Port McNicoll, and rail from there to Montreal and the Atlantic Seaboard for export. The volume of this traffic is shown in Tables Nos. 20, 22, and 23. The average for the last four years has been about 410,000 tons. This business would be available for the St. Lawrence Waterway. It has had a steady growth in the past and for the purpose of this estimate 450,000 tons per year will be taken as the volume available.

49. The total annual saving effected in the cost of transporting this class of goods at \$3.60 per ton (See Par. 28c) will be approximately \$1,600,000.

50. *Lumber.*—The production of lumber in Ontario and Quebec is falling at the rate of 52 million board feet per annum. The reduction in Ontario alone amounts to 60 million board feet. The supply, of course, in these provinces will never be completely exhausted but the production will have to be materially curtailed. Since British Columbia is estimated to possess three quarters of the saw material available in Canada, it is obvious that Ontario must look to that province for a large part of its supply. One half of the timber sawn in Ontario is white pine, which commands a high price in foreign markets. For this reason, it is likely that the export trade will be maintained and cheaper material brought in from British Columbia. Information in regard to the rail shipments of lumber from the Pacific to eastern Canada is hard to obtain but it is estimated that this business has increased from 150,000,000 B.F. in 1917 to 250,000,000 B.F. in 1920. Since that time, the shipments by rail have greatly increased and an all-

water movement via the Panama Canal has developed. Statistics of the Panama Canal show that this movement developed from approximately 1,000,000 B.F. in 1923, to 60,000,000 B.F. in 1927 (a). What the total movement will aggregate on the completion of the proposed waterway cannot be estimated accurately but a fair assumption is about 400,000,000 B.F. or 800,000 tons per annum.

51. The present rail freight rate on lumber from Vancouver to Toronto is 88½ cents per 100 pounds which is equivalent to \$29.25 per 1,000 B.F. Ocean freight rates via the Panama Canal from B.C. to Montreal, during 1927, ranged from \$12 to \$15 per 1,000 B.F. The rail haul from Montreal to Toronto plus transfer charges at Montreal is approximately \$8.25 per 1,000 B.F. This shows a saving of approximately \$6 to \$9 per 1,000 B.F. on the present all water movement to Montreal plus rail haul to Toronto over an all rail haul from Vancouver to Toronto.

52. The saving in transportation costs effected by the St. Lawrence Deep Waterway will be represented by the saving in cost of a transfer at Montreal and the difference between rail and water transportation between Montreal and Toronto. The cost of a transfer at Montreal on this class of goods can be taken at \$1.75 per ton. The saving in cost of transportation will be at least \$1.25. This means a total saving of \$3 per ton and on an annual movement of 800,000 tons, this would amount to \$2,400,000 per year.

(a) Compiled from Panama Records. (Official publication of the Panama Canal.)

53. *Coal*.—The importation of anthracite coal from the United Kingdom has gradually been on the increase during the past four years. The following table shows the imports by calendar years:—

IMPORTS OF ANTHRACITE COAL FROM UNITED KINGDOM*

Year	Imports at Montreal	Total imports
1922.....	118,416	183,050
1923.....	181,552	261,675
1924.....	215,420	273,277
1925.....	431,152	557,259
1926.....	159,640	273,055
1927.....	683,003	798,281

*Supplied by Editor of Canada Year Book—Bureau of Statistics.

It will be noted that the imports for 1926 took a considerable slump from the previous year but this was due to the strike of coal miners in Great Britain. Approximately 80 per cent of the total imports are received at the port of Montreal. At the present time the rail haul from Montreal to Toronto prohibits the extensive use of this fuel other than in small quantities in central and western Ontario. With the completion of the St. Lawrence Waterway the imports direct to Toronto and central Ontario will develop although its magnitude is very hard to estimate. A conservative estimate is 800,000 tons per annum as the volume which would be possible to move via the proposed waterway.

54. The saving in transportation costs on coal will be represented by a saving in transfer at Montreal plus the difference in cost between transportation by rail and transportation by the proposed waterway. This has been estimated as \$2.50 per ton showing an annual saving on anthracite coal of \$2,000,000.

55. *Other Commodities*.—The volume of traffic that is likely to develop in other commodities is difficult to determine as accurately as that in grain, lumber,

or coal. The natural growth of the West will mean a larger importation of goods both from Eastern Canada and the United Kingdom. Exports of manufactured goods from Ontario will increase. The increased demand for fertilizers in western Ontario may mean the development of a large traffic, the volume of which cannot be estimated.

56. From an examination of the imports and exports of goods into and from Canada, a percentage of which might be counted on to utilize the waterway, it is not difficult to identify a westward movement of at least 1,000,000 tons on which \$2.50 per ton would be saved and an equal volume of east and west movement on which 50 cents per ton would be saved. This represents an annual saving of \$3,000,000.

SUMMARY

57. In summarizing the annual savings in transportation costs due to cheaper transportation via the proposed St. Lawrence Deep Waterway as set out in the previous paragraphs, it must be borne in mind that the figures below do not include anything due to the intangible benefits that cannot be estimated on, such as new industries that are sure to develop due to the supply of large amounts of cheap power and new markets that are sure to be opened up due to decreased costs of transportation.

58. Totalling the estimated annual savings in transportation costs on the various commodities noted above, the following total annual saving is obtained:—

Grain.....	\$ 6,000,000—see para. 47.
Flour.....	1,600,000—see para. 49.
Lumber.....	2,400,000—see para. 52.
Coal.....	2,000,000—see para. 54.
Other commodities.....	3,000,000—see para. 56.

Total annual saving..... \$15,000,000

This estimated annual saving is used in compiling Tables Nos. 48 and 49, showing the annual charges and benefits arising from the St. Lawrence Waterway Project.

DRAUGHT

59. An important feature, in an economic study of the proposed deep waterway, is the question of whether or not a sufficient number of ocean carrying ships will be able to navigate the channels and locks, if these are built as proposed.

60. Ocean vessels increase their draught when moved from salt to fresh water. This increase is from 4 to 7 inches for cargo ships of 25 to 28 feet draught. An allowance for clearance under keels must also be made for the ships passing through restricted channels and locks. A clearance of 2 feet is ample for safe navigation in river channels, and about 6 inches in locks. A boat of 25 feet draught requires a channel swept to 27 feet.

61. The fact that a channel of 27 feet depth between the Great Lakes and the ocean will be sufficient to attract ocean tonnage can be established in a number of ways. The most economical size of ship for various trades has been established by a number of authorities.

62. An article on this subject was prepared by Mr. John Anderson, and was published in the Transactions of the Institute of Naval Architects of England in 1918. Another was prepared by Mr. Alfred Robertson, and published in the Transactions of the Naval Architects of New York in 1921. These investigations show that for voyages of 4,000 knots, freight ships of 8,000 tons deadweight carrying capacity, or 5,000 tons gross register, provide a freight rate 20 cents per ton less than boats of 5,500 tons deadweight or 3,700 tons gross register under similar conditions.

63. With a channel depth of 27 feet provided, practically all ships afloat in the world between 4,000 and 5,000 tons and 50 per cent of those between 5,000 and 6,000 tons could use the route. This depth would enable approximately 8,360 registered ships or 27,500,000 gross tons of shipping to enter the Great Lakes. (See Table No. 36.) From the above, it is obvious that the moving of 20,000,000 tons of goods from the Great Lakes to the Atlantic could be accomplished in eight months without disturbing other trade routes to any great extent.

64. Statistics show that the number of ships between 2,000 and 4,000 tons gross register have been falling for a number of years. The number between 4,000 and 6,000 tons has been fairly constant, while the number between 5,000 and 6,000 tons gross register have been increasing at a rate corresponding to larger ships. (See Table No. 37.) This would indicate that cargo carriers of 5,000 to 6,000 tons gross register have been found to be the most economical for general ocean trade routes.

65. Statistics of Panama Canal traffic for a six-months' period in 1927 show that, excluding tankers, naval boats, and boats in ballast, on an eastbound passage, 84 per cent of the total passages are cargo carriers drawing 25 feet and under, and correspondingly on a westbound passage, approximately 60 per cent are boats drawing 25 feet or less.

66. Excluding passenger-cargo ships and tankers, the Department of Commerce of the United States estimate 89 per cent of the total entrances and clearances from United States ports to be in vessels of 25 feet draught and under. These carry 82 per cent of the foreign commerce of the United States.

RETURN CARGOES

67. Critics of the proposed waterway have repeatedly made the assertion that the big bulk of the foreign commerce of the Great Lakes region will consist of grain and that this, in itself, will not attract sufficient ocean boats to handle it, owing to the fact that such boats will, of necessity, have to proceed to the head of the lakes in ballast. These assertions are open to challenge.

68. It is, naturally, very desirable that boats should have return cargoes for the simple reason that cargo tonnage costs are materially reduced, but the assumption that they must have return cargoes, is not upheld by shipping statistics of various trade routes, and ports of the world.

69. Liner trade must not be confused with that of tramp ships. The former is established to the extent justified by the cargo to and from specific trade zones. Tramp steamers are not limited to any trade route and will go to any port where either whole or part cargoes are available. They are thus able to offset weak cargo conditions existing on individual routes.

70. Statistics of the port of Montreal show that exports from that port are double the imports. From tables published in the report of A. H. Ritter on Transportation Economics of the Great Lakes—St. Lawrence Ship Channel published in 1925, exports from Atlantic ports to the United Kingdom exceeded imports by a ratio of about 4 to 1, gulf ports by 25 to 1, and Pacific ports by 10 to 1. In 1922, of the total number of vessels entering U.S. ports, approximately 25 per cent were in ballast while clearances in ballast are only about 2 per cent. These figures clearly indicate that trade routes are not balanced.

71. Conditions on the Great Lakes are very favourable for return cargoes. The tributary territory contains about one-third of the entire population of the United States and about the same proportion of the population of Canada. Import business will be developed in proportion to consumption in this territory. These districts now consume several millions of tons of foreign goods annually,

which are brought in by rail from Atlantic ports. Ideal conditions for maintenance of shipping service exists on the Great Lakes, in that there is bulk and package freight for outbound cargoes, large manufacturing industries for consumption of foreign raw material, and a large population which consumes the food and manufactured products of other countries.

PART "B"—VALUE TO THE UNITED STATES

72. A study of United States' potential traffic available for movement by the proposed St. Lawrence Waterway has recently been made and published in a document "Great Lakes to Ocean Waterways" Domestic Commerce Series No. 4, Department of Commerce of the United States of America, 1927. The results of this study have been summarized as briefly as possible and are presented herewith in paragraphs 73 to 76 inclusive.

ESTIMATE OF POTENTIAL TRAFFIC

73. This estimate was derived by dividing it into several distinct classes: export, import, intercoastal, and coastwise. The tributary territory to and from which this traffic may move was taken as comprising the following states: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, Iowa, Nebraska, Kansas, and Missouri. Approximately one-third of the total population of the United States is segregated in this territory. Seventy-two per cent of all grain production, and 37 per cent of all manufactures originate in this region.

74. A brief synopsis of the potential tonnage available for the waterway as estimated by the authors of the above mentioned treatise would indicate about 6,400,000 tons of export traffic, approximately 3,000,000 tons of import traffic and 7,000,000 tons of intercoastal and coastwise, giving a grand total of 16,400,000 tons which would be available during the season of navigation of the Great Lakes. This figure is conservative and does not account for increased transportation requirements by the time the proposed waterway would be completed.

TRANSPORTATION COSTS ON GRAIN

75. The predominating movement of the export grain trade of the United States, at the present time, includes an all rail haul to seaboard ports and thence abroad by liner or tramp steamer. In 1924, grain rates from Chicago to Liverpool via New York were quoted as follows: all rail to seaboard, \$0·221 per bushel; lake and rail, \$0·217 per bushel; and all water, \$0·196 per bushel. Via Montreal, the rates were: all rail to seaboard, \$0·218 per bushel, and all water, \$0·1766. It will be seen that the cheapest existing route from Chicago to Liverpool in 1924, was via Montreal, at a rate of about 17·5 cents per bushel.

76. The authors of the previous mentioned treaties have made an analysis of the possible savings to be made on grain for export trade via the proposed waterway, and have estimated a possible saving of from 6·4 to 9·6 cents per bushel over the lowest existing combination of rates. This would average about \$3 per ton.

77. In compiling Tables Nos. 48 and 49, showing the annual charges and benefits arising from the St. Lawrence Waterway Project, a saving of \$1·35 per ton on 16,400,000 tons of United States' Traffic, is taken. On grain, this is equivalent to approximately 3·5 cents per bushel.

LUMBER

78. The location of the furniture industry of the United States is largely centred in the state of Michigan and several bordering states, due, primarily, to the immense stands of hardwood in Michigan. Owing to the tremendous

growth in population and consequent increase in lumber requirement, as well as large export shipments, available stands of timber have become almost depleted. These states have to rely on the Pacific and south coast regions for about 77 per cent of their lumber requirements. About 25 per cent of this necessary supply is obtained from the Pacific coast and moves to the Great Lakes region by two routes: all rail direct, and all water via Panama canal to the Atlantic coast plus rail haul to Great Lakes region.

79. Statistics of the Department of Agriculture of the United States show that in 1922, Michigan and Illinois consumed 1,700,000 tons of lumber imported from other states. Approximately 400,000 tons of this amount was supplied by Pacific coast regions.

80. Savings in transportation by various indicated routes have been figured on the basis of out-of-pocket costs. These show that the saving to be effected by an all-water haul from the Pacific coast via the Panama canal and proposed St. Lawrence Waterway to Chicago, over the all-rail movement direct, would amount to approximately \$9 per M.B.F. The saving to be made by the former over a movement to New York by water, transfer at New York and rail haul to Chicago, is somewhat less, or about \$8 per M.B.F.

IRON ORE

81. The Lake Superior region produces 85 per cent of the total production of iron ore in the United States. In 1926, the production of this region was about 57,314,000 tons and the whole of this was moved by Great Lake freighters to ports on Lakes Erie and Michigan for distribution to smelting centres. A small proportion of this Lake Superior ore reaches the Atlantic region due to the very high cost of an all-rail haul from Lake Erie ports. This haul has been estimated to be about two and one-half times the cost of the water movement from Lake Superior to Lake Erie although the actual mileage of the latter is twice that of the former.

82. In 1923, the distribution of Lake Superior ore to smelters on and near the Atlantic coast was as follows:*

Philadelphia.....	500,000 tons
Bethlehem.....	500,000 "
Wharton, N.J.....	40,000 "
Sparrows Pt., Md.....	50,000 "
Total.....	1,090,000 tons

83. During the same year, imports of iron ore to this region from foreign countries approximated 2,800,000 tons or about 4 per cent of the total production of the United States. The importation of foreign ore is not due to scarcity of the product in the United States but to the fact that it can be delivered for considerably less to the Atlantic coast regions than the Lake Superior ore.

84. With the proposed development of a deep waterway between the Great Lakes and the ocean, and consequent cheaper methods of transportation, there should be a marked increase in shipments of Lake Superior ore to the Atlantic coast regions.

PACKAGE FREIGHT

85. The big bulk of the package freight business to and from the Great Lakes region is handled through the port of New York. With a waterway from the ocean to the Great Lakes, such as proposed, a percentage of this class of goods may be expected to utilize such a route during the navigation season without interfering with tonnage on United States railroads to a very large extent, as they are, at the present time, taxed to capacity.

* Taken from "Transportation Economics of the Great Lakes—St. Lawrence Ship Channel," by Alfred H. Ritter, 1925.

86. An investigation of indicated saving by transportation of this route over an all rail haul from New York to Chicago has been made, based on actual out-of-pocket costs of operation. Studies of railway statistics of the United States show the out-of-pocket cost of operation of such a route as the above to be about 5.8 mills per ton-mile plus a turn around charge of 40 cents. Applying these figures to the total mileage shows the cost of rail haul on package freight to be about \$5.70 per ton. The cost, as figured, by tramp steamer on a basis of no return cargo, is about \$2.70 per ton, which would indicate a possible saving of about \$3 per ton.

SUMMARY

87. Based on 16,400,000 tons of traffic as estimated by the U.S. Department of Commerce Report referred to in para. 72, the annual saving in transportation costs to the United States, at \$1.35 per ton, will amount to about \$22,200,000 per year.

88. Studies made by various interested parties in the United States on the economics of the St. Lawrence Waterway have placed too much emphasis on the grain trade and its possibilities both as to volume of potential traffic and savings to be effected over prevailing routes and have only casually investigated other classes of available tonnage, which would, after all, form the large part of traffic on the waterway.

89. No attempt has been made to analyze the total probable saving to the United States of this route, but there is every reason to believe that it should stimulate foreign and domestic trade of the Great Lakes region and by making possible more economical transportation between this region and points on and near the Atlantic, Gulf, and Pacific coasts, should either directly or indirectly be a benefit to the entire United States.

PART "C"—ANNUAL CHARGES AND BENEFITS FROM ST. LAWRENCE WATERWAY PROJECT

90. Tables Nos. 48 and 49 show the annual charges that would be incurred and the estimated benefits resulting from the construction of the St. Lawrence Waterway Project.

91. Table No. 48 is built up, assuming the Crysler Island Two-Stage Project built in the International Section and the Hungry Bay-Melocheville Project for navigation alone in the Soulanges Section.

92. This shows total annual charges of \$26,653,000 against total annual benefits of \$67,890,000 derived from power and savings in transportation costs.

93. Table No. 49 shows the annual charges due to the works solely for navigation and benefits due to savings in transportation costs only. This shows a benefit of \$37,200,000 against annual charges of \$8,404,000.

G. A. LINDSAY,
D. W. McLACHLAN.

TABLE 1.—TABLE SHOWING LENGTH OF VARIOUS ROUTES IN STATUTE MILES

Route	Locks	Canal	Re- stricted channel	River	Lake or ocean	Total
	No.	Miles	Miles	Miles	Miles	Miles
<i>Existing Routes—</i>						
Fort William—Port McNicoll.....	1	1	19	56	465	541
Fort William—Port Colborne.....	1	1	52	100	695	848
Fort William—Buffalo.....	1	1	52	100	713	866
Port Colborne—Gananoque.....	26	27	.....	27	159	213
Port Colborne—Prescott.....	26	27	.....	63	159	249
Port Colborne—Montreal.....	47	70	.....	139	159	368
Prescott—Montreal.....	21	43	.....	77	.....	120
Gananoque—Montreal.....	21	43	.....	124	.....	167
Montreal—Quebec.....	.....	.....	64	97	.....	161
Quebec—Sydney.....	.....	.....	23	650	.....	673
Sydney—Liverpool.....	.....	.....	.....	.....	2,624	2,624
Quebec—Liverpool (via Belle Isle) ..	.....	.....	23	847	2,158	2,928
New York—Liverpool.....	.....	.....	.....	.....	3,571	3,571
<i>With Welland ship canal—</i>						
Fort William—Gananoque.....	9	27	52	127	850	1,056
Fort William—Prescott.....	9	27	52	163	850	1,092
<i>With Welland ship canal and St. Lawrence deep waterway—</i>						
Fort William—Montreal.....	18	56	78	228	850	1,212

TABLE No. 2.—STATEMENT SHOWING CHARACTERISTICS AND PERFORMANCE OF SHIPS

	Canal size ship	Ocean tramp 8,500 ton	Lake freighter
Deadweight carrying capacity.....	2,400 tons	8,500 tons	12,000 tons
Length.....	253 ft.	430 ft.	600 ft.
Beam.....	43-0 "	54-0 "	58-0 "
Depth.....	.....	28-4 "	.....
Draft.....	14-2 "	24-0 "	21-0 "
Gross tonnage.....	.....	5,752 tons	8,750 tons
Weight of ship.....	.....	3,610 "	.....
Crew.....	20	40	30 (on lake)
I.H.P.....	.....	2,515 h.p.	.....
Speed—knots per hour—	.....	.....	.....
Calm weather.....	10-0	10-0	10-0
Average.....	9-7	9-7	9-7
Coal consumed per day—	.....	.....	.....
On voyage.....	16 tons	35 tons	42 tons
In port.....	2-5 "	5-5 "	6 "
Stores per day—	.....	.....	.....
At sea.....	8 "	16 "	14 "
In fresh water.....	2 "	5 "	5 "
Cost per ship.....	\$190,000	\$,480,000	\$750,000
Operating season.....	230 days	330 days	230 days
Expenses per day—Fixed charges—	.....	.....	.....
Interest.....	6%	.....	.....
Depreciation.....	4%	.....	.....
Maintenance and repairs.....	3%	.....	.....
.....	13%	.....	.....
13%.....	\$107	\$189	\$414
Crew and sustenance.....	70	132	105
Coal on voyage.....	80	175	210
In port.....	13	27	30
Engine and deck stores.....	15	33	36
Management.....	5	14	16
Total expense per day—	.....	.....	.....
On voyage.....	\$277	\$543	\$791
In port.....	210	395	611

If voyage between Montreal and Prescott, add 72 cents per ton for coal.

Total expense per day—

On voyage, \$289.

In port, 212.

If voyage between Fort William and Georgian Bay ports, add 72 cents per ton for coal.

Total expense per day—

On voyage, \$821.

In port, 616.

Compiled from information supplied by Ship Builders in Canada, United States, and United Kingdom and by various shipping companies.

TABLE No. 3.—SUMMARY SHOWING TIME OF NAVIGATION ON WATERWAYS IN DAYS

Ships loaded with bulk freight on Eastbound trip only.

Routes	Time of route	Terminal time and delay	Total time
<i>Existing Routes—</i>			
A. Fort William to Port McNicoll and return.....	4.24	3.50	7.74
B. Fort William to Buffalo and return.....	6.80	3.50	10.30
C. Fort William to Port Colborne and return.....	6.60	3.50	10.10
D. Port Colborne to Montreal and return.....	6.20	3.25	9.45
E. Gananoque to Montreal and return.....	3.00	3.25	6.25
F. Prescott to Montreal and return.....	2.60	3.25	5.85
J. Montreal to Liverpool and return.....			
Outbound via Sydney—Inbound via Belle Isle.....	25.95	4.00	29.95
K. New York to Liverpool and return.....	27.10	4.00	31.10
<i>With Welland Ship Canal—</i>			
G. Fort William to Gananoque and return.....	9.10	3.50	12.60
H. Fort William to Prescott and return.....	9.30	3.50	12.80
<i>With Welland Ship Canal and St. Lawrence Deep Waterway—</i>			
I. Fort William to Montreal and return.....	11.20	3.50	14.70

TABLE 4.—STATEMENT SHOWING TIME OF NAVIGATION OF WATERWAYS

(Ships loaded with bulk freight on East bound trip only)

A. *Fort William to Port McNicoll and return—*

(Standard Ship—600' x 58' x 21' draft)

2 Lockages at 0.8 hrs..... = 1.6 hours

2 Miles canal 200' wide at 5 m.p.h..... = 0.40 "

38 " Restricted and shoal water at 9 m.p.h..... = 4.22 "

112 " River at 10 m.p.h..... = 11.20 "

930 " Lake at 11 m.p.h..... = 84.55 "

Terminal time..... 101.97 " = 4.24 days

3.50 " = 3.50 "

Total time..... 7.74 days

B. *Fort William to Buffalo and return—*

(Standard Ship—600' x 58' x 21' draft)

2 Lockages at 0.8 hrs..... = 1.6 hours

2 Miles Canal—200' wide at 5 m.p.h..... = 0.40 "

104 " Restricted and Shoal Water at 9 m.p.h..... = 11.55 "

200 " River at 10 m.p.h..... = 20.00 "

1,426 " Lake at 11 m.p.h..... = 129.60 "

Terminal time..... 163.15 " = 6.8 days

3.5 " = 3.5 "

Total time..... 10.3 "

C. *Fort William to Port Colborne and return—*

(Standard Ship—600' x 58' x 21' draft)

2 Lockages at 0.8 hrs..... = 1.6 hours

2 Miles Canal—200' wide at 5 m.p.h..... = 0.40 "

104 " Restricted and Shoal Water at 9 m.p.h..... = 11.55 "

200 " River at 10 m.p.h..... = 20.00 "

1,390 " Lake at 11 m.p.h..... = 126.27 "

Terminal time..... 159.82 hours = 6.6 days

3.5 " = 3.5 "

Total time..... 10.1 days

SPECIAL COMMITTEE

TABLE No. 4—Continued

D. *Port Colborne to Montreal and return, via present canal system—*
(Canal Size Boat—253' x 43' x 14' draft)

94 Lockages at 0.6 hrs.	= 56.4 hours
140 Miles Canal—100' wide at 4 m.p.h.	= 35.0 "
278 " River at 10 m.p.h.	= 27.8 "
318 " Lake at 11 m.p.h.	= 28.9 "

148.1 hours = 6.2 days

Terminal time.....	3.0 "
Delay—Prescott to Dickinson Landing.....	0.25 "

Total time..... 9.45 "

E. *Gananoque to Montreal and return via present canal system—*
(Canal Size Boat—253' x 43' x 14' draft)

42 Lockages at 0.6 hrs.	= 25.2 hours
86 Miles Canal—100' wide at 4 m.p.h.	= 21.5 "
248 " River at 10 m.p.h.	= 24.8 "

71.5 hours = 3.0 days

Terminal time.....	3.0 "
Delay—Prescott to Dickinson Landing.....	0.25 "

Total time..... 6.25 "

F. *Prescott to Montreal and return via present canal system—*
(Canal Size Boat—253' x 43' x 14' draft)

42 Lockages at 0.6 hrs.	= 25.2 hours
86 Miles Canal—100' wide at 4 m.p.h.	= 21.5 "
154 " River at 10 m.p.h.	= 15.4 "

62.1 hours = 2.6 days

Terminal time.....	3.0 "
Delay—Prescott to Dickinson Landing.....	0.25 "

Total time..... 5.85 "

G. *Fort William to Gananoque via enlarged Welland Ship Canal—*
(Standard Ship—600' x 58' x 21' draft)

18 Lockages at 0.8 hrs.	= 14.4 hours
54 Miles Canal—200' wide at 5 m.p.h.	= 10.8 "
104 " Restricted and Shoal Water at 9 m.p.h.	= 11.6 "
154 " River at 10 m.p.h.	= 25.4 "
1,700 " Lake at 11 m.p.h.	= 154.5 "

216.7 " = 9.1 days

Terminal time.....	3.5 "
--------------------	-------

Total time..... 12.6 "

H. *Fort William to Prescott via enlarged Welland Ship Canal—*
(Standard Ship—600' x 58' x 21' draft)

18 Lockages at 0.8 hrs.	= 14.4 hours
54 Miles Canal—200' wide at 5 m.p.h.	= 10.8 "
104 " Restricted and Shoal Water at 9 m.p.h.	= 11.6 "
326 " River at 10 m.p.h.	= 32.6 "
1,700 " Lake at 11 m.p.h.	= 154.5 "

223.9 hours = 9.3 days

Terminal time.....	3.5 "
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Total time..... 12.8 days

I. *Fort William to Montreal and return via improved St. Lawrence and Welland Ship Canals—*
(Ocean Tramp—430' x 54' x 24' draft)

36 Lockages at 0.8 hrs.	= 28.8 hours
112 Miles Canal—200' wide at 5 m.p.h.	= 22.4 "
156 " Restricted and Shoal Water at 9 m.p.h.	= 17.3 "
456 " River at 10 m.p.h.	= 45.6 "
1,700 " Lake at 11 m.p.h.	= 154.5 "

268.6 hours = 11.2 days

Terminal time.....	3.5 "
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Total time..... 14.7 days

TABLE No. 4—Concluded

J. *Montreal to Liverpool and return—*Route—Outbound via Sydney, inbound via Belle Isle.
(Ocean Tramp—430' x 54' x 24' draft)(a) *Via Sydney—*

Montreal to Quebec—

64 Miles Restricted and Shoal Water at 9 m.p.h.....	= 7.1 hours
97 " River at 10 m.p.h.....	= 9.7 "

16.8 hours = 0.70 days

Quebec to Sydney—

23 Miles Restricted and Shoal Water at 9 m.p.h.....	= 2.6 hours
650 " River Gulf at 10 m.p.h.....	= 65.0 "

67.6 hours = 2.80 days

Sydney to Liverpool—

2,624 Miles—Ocean at 11 m.p.h.....	= 238.5 hours = 9.95 days
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Total time (via Sydney).....	13.45 days
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(b) *Via Belle Isle—*

Montreal to Quebec as above.....	0.70 days
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Quebec to Liverpool—

23 Miles restricted and Shoal Water at 9 m.p.h.....	= 2.6 hours
847 " River and Gulf at 10 m.p.h.....	= 84.7 "
2,158 " Ocean at 11 m.p.h.....	= 196.2 "

283.5 hours = 11.8 days

Total time (via Belle Isle).....	12.5 days
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(c) Terminal time.....	4.0 days
------------------------	----------

Total time (Return Trip).....	29.95 days
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K. *New York to Liverpool and return—*

(Ocean Tramp—430' x 54' x 24' draft)

7,142 Miles Ocean—at 11 m.p.h.....	= 649.3 hours = 27.1 days
Terminal time.....	4.0 "

Total time.....	31.1 days
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TABLE No. 5—STATEMENT SHOWING ESTIMATED COST OF OPERATION OF A TYPICAL
TRANSFER ELEVATOR TRANSFERRING 33,000,000 BUSHEL PER YEAR
FROM ONE SHIP TO ANOTHER—IN DOLLARS

Staff.....	36,000
Repairs.....	30,000
Shovelling.....	42,000
Power.....	14,000
Insurance (on grain).....	4,000
Shortage and Shrinkage.....	18,000
Interest, 2,400,000 at 6 per cent.....	144,000
Depreciation.....	49,000
Insurance (on building).....	4,200
	<hr/> 341,200
Add management and overhead 10 per cent.....	34,100
	<hr/> 375,300 = 1.14 cents per bush.

The above figures include the cost of all harbour improvements outside of the canal proper. The estimated cost as shown above is about that collected at the Georgian Bay Ports, Buffalo, Montreal and Portland on the total handled at these points, taking into account the fact that a proportion of the grain handled remains in the elevator longer than the free storage period.

If the storage period was short, and the total quantity handled was increased, the cost per bushel would be decreased from that shown above.

TABLE 6.—STATEMENT SHOWING INSURANCE AND PILOTAGE RATES—VARIOUS ROUTES

Ship.....	Canal size ship	Ocean tramp ship	Lake freighter
Carrying capacity.....	2,400 tons	8,500 tons	12,000 tons
Cost.....	\$190,000	\$480,000	\$750,000
Operating season.....	230 days	330 days	230 days

Routes	May 1 to Sept. 30	Oct. 1 to Oct. 31	Nov. 1 to Nov. 25	May 1 to Sept. 30	Oct. 1 to Oct. 31	Nov. 1 to Nov. 25	May 1 to Sept. 30	Oct. 1 to Oct. 31	Nov. 1 to Nov. 25
<i>Fort William to Georgian Bay or Buffalo—</i>									
Hull Insurance per year.....	31%	31%	31%				31%	31%	31%
Equivalent per day.....	\$20	\$20	\$20				\$114	\$114	\$114
Cargo Insurance—per ton at \$50.00 per ton	\$0-0375	\$0-05	\$0-0625				\$0-0375	\$0-05	\$0-0625
<i>Fort William to Gananoque—</i>									
Hull Insurance per year.....	5%	5%	5%				5%	5%	5%
Equivalent per day.....	\$42	\$42	\$42				\$163	\$163	\$163
Cargo Insurance—per ton at \$50.00 per ton	\$0-05	\$0-05	\$0-059				\$0-05	\$0-05	\$0-059
<i>Fort William to Prescott—</i>									
Hull Insurance per year.....	6%	6%	6%				6%	6%	6%
Equivalent per day.....	\$50	\$50	\$50				\$196	\$196	\$196
Cargo Insurance—per ton at \$50.00 per ton	\$0-065	\$0-065	\$0-077				\$0-065	\$0-067	\$0-077
<i>Fort William to Montreal—</i>									
Hull Insurance per year.....	7½%	7½%	7½%				6%	6%	6%
Equivalent per day.....	\$62	\$62	\$62				\$195	\$195	\$195
Cargo Insurance—per ton at \$50.00 per ton	\$0-0875	\$0-0875	\$0-102				\$0-0875	\$0-0875	\$0-102
<i>Fort William to Sydney—</i>									
Hull Insurance per year.....				6%	7%	7-5%			
Equivalent per day.....				\$88	\$102	\$109			
Cargo Insurance—per ton at \$50.00 per ton				\$0-2125	\$0-239	\$0-268			
Pilotage per return trip above Gulf.....				\$660	\$660	\$720			
Pilotage at Sydney.....				\$75	\$75	\$75			
<i>Montreal to Liverpool—</i>									
Hull Insurance per year.....				5%	5-3%	5-7%			
Equivalent per day.....				\$73	\$77	\$82			
Cargo Insurance per ton at \$50.00 per ton				\$0-25	\$0-31	\$0-45			
Pilotage per trip—Canadian end.....				\$331	\$331	\$360			
<i>Sydney or New York to Liverpool—</i>									
Hull Insurance per year.....				2½%	2½%	2½%			
Equivalent per day.....				\$37	\$37	\$37			
Cargo Insurance—per ton at \$50.00 per ton				\$0-125	\$0-15	\$0-17			
Pilotage—New York.....				\$200	\$200	\$200			
Pilotage—Sydney.....				\$75	\$75	\$75			

TABLE 7.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN—VIA PRESENT SYSTEM OF CANALS (FORT WILLIAM TO LIVERPOOL)

Assuming No Return Cargoes

1. *Fort William to Port Colborne—12,000 Ton Ship—*

Coal consumed 6-6 days at 42.....	=	277 tons
Coal consumed 3-5 days at 6.....	=	21 "
Stores consumed 10-1 days at 5.....	=	50 "

Net cargo=12,000 tons less.....	348	"	=11,652 tons
6-6 days on voyage at \$791.....	=	\$5,220	
3-5 days in port at \$611.....	=	2,140	
Insurance—Hull—10-1 days at \$114.....	=	1,152	
Cargo—11,652 tons at 0-0375.....	=	436	

Total cost.....	\$8,948 per	11,652 tons	= \$0 77 per ton
Transfer at Port Colborne at 1-14c. per bush.....			0 42 "

2. *Port Colborne to Montreal.—2,400 Ton Ship—Coaling at Charlotte—*

Coal consumed 6-2 days at 16.....	=	99 tons
Coal consumed 3-25 days at 2-5.....	=	8 "
Stores consumed 9-45 days at 2-0.....	=	20 "

Net cargo=2,400 tons less.....	127	"	= 2,273 tons
6-2 days on voyage at \$277.....	=	\$1,716	
3-25 days in port at \$210.....	=	682	
Insurance—Hull—9-45 days at \$62.....	=	586	
Cargo—2,273 tons at 0-0875.....	=	199	

Total cost.....	= \$3,183 per	2,273 tons	= \$1 40 per ton
Transfer at Montreal at 1-14c. per bush.....			0 42 "

TABLE No. 7—Concluded

3. <i>Montreal to Liverpool</i> .—8,500 ton ship—			
Outbound via Sydney—Inbound via Belle Isle.			
Coaling at Liverpool and Sydney.			
Coal consumed 10 days at \$5.....	=	350 tons	
Coal consumed 2 days at 5-5.....	=	11 "	
Stores consumed 15 days at 16.....	=	240 "	
Net cargo—8,500 tons less.....		601 "	= 7,899 tons
25-95 days on voyage at \$543.....	=	\$14,091	
4-00 days in port at \$395.....	=	1,580	
Insurance—Hull—25-95 days at \$73.....	=	1,892	
Cargo—7,899 tons at 0-25.....	=	1,975	
Pilotage to Montreal.....	=	331	
Pilotage to Sydney for coal.....	=	75	
Total cost.....	\$19,944 per	7,899 tons	=\$2 53 per ton
Transfer to warehouse at Liverpool at 9/10c. per bush.....			0 33 "
Total cost—May 1 to Sept. 30.....			\$5 87 "
Total cost—Oct. 1 to Oct. 31.....			5 95 "
Total cost—Nov. 1 to Nov. 30.....			6 13 "

TABLE 8.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN—VIA PORT McNICOLL AND MONTREAL (FORT WILLIAM TO LIVERPOOL)

Assuming No Return Cargoes

1. <i>Fort William to Port McNicoll</i> .—12,000 ton ship—			
Coal consumed 4-24 days at 42.....	=	178 tons	
Coal consumed 3-5 days at 6.....	=	21 "	
Stores consumed 7-74 days at 5.....	=	39 "	
Net cargo—12,000 tons less.....		238 "	= 11,762 tons
4-24 days on voyage at \$821.....	=	\$3,481	
3-50 days in port at \$616.....	=	2,160	
Insurance—Hull—7-74 days at \$114.....	=	884	
Cargo—11,762 tons at 0-0375.....	=	441	
Total cost.....	=\$6,966 per	11,762 tons	=\$0 59 per ton
Transfer at Port McNicoll at 1-14c. per bush.....			0-42 "
2. <i>Rail to Montreal</i> .—365 miles at 0-58 per ton mile.....			
Transfer at Montreal at 1-14c. per bush.....			\$2 12 per ton
			0 42 "
3. <i>Montreal to Liverpool</i>			
As shown on Table No. 7.....			\$2 53 per ton
Transfer into warehouse at Liverpool at 9/10c. per bush.....			0 33 "
Total—May 1 to Sept. 30.....			\$6 41 "
Total—Oct. 1 to Oct. 31.....			6 50 "
Total—Nov. 1 to Nov. 30.....			6 67 "

TABLE 9.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN VIA BUFFALO AND NEW YORK (FORT WILLIAM TO LIVERPOOL)

Assuming No Return Cargoes

1. <i>Fort William to Buffalo</i> .—12,000 ton ship—			
Coal consumed 6-8 days at 42.....	=	286 tons	
Coal consumed 3-5 days at 6.....	=	21 "	
Stores consumed 10-3 days at 5.....	=	51 "	
Net cargo—12,000 tons less.....		358 tons	= 11,642 tons
6-8 days on voyage at \$791.....	=	\$5,378	
3-5 days in port at \$611.....	=	2,140	
Insurance—Hull—10-3 days at \$114.....	=	1,175	
Cargo—11,642 tons at 0-0375.....	=	436	
Total cost.....	=\$9,129 per	11,642 tons	=\$0 78 per ton
Transfer at Buffalo at 1-14c. per bush.....			0 42 "
2. <i>Rail to New York</i> —			
396 miles at 0-58 per ton mile.....			=\$2 24 per ton
Transfer at New York at 1-06c. per bush. to tramp -39			
Transfer at New York at 1-06c. per bush to liner -60.....			0 60 "

TABLE No. 9—Concluded

3. *New York to Liverpool*.—8,500 ton ship—

Coal consumed 13.55 days at 35.....	=	474 tons	
Coal consumed 2.0 days at 5.5.....	=	11 "	
Stores consumed 15.55 days at 16.....	=	249 "	
Net cargo—8,500 tons less.....		734 "	= 7,766 tons
27.1 days on voyage at \$543.....	=	\$14,715	
4.0 days in port at \$395.....	=	1,580	
Insurance—Hull—31.1 days at \$37.....	=	1,150	
Cargo—7,766 tons at 0.125.....	=	973	
Pilotage.....	=	200	
Total cost.....	=	\$18,618 per	7,766 tons
		= 2.40 per ton	
Liner rate=70 p.c. tramp rate=70 p.c. of \$2.40.....			=\$1 68 per ton
Transfer into warehouse at Liverpool—9/10c. per bush.....			= 0 33 "
Total cost—May 1 to Sept. 30.....			\$6 05 "
Total cost—Oct. 1 to Oct. 31.....			6 08 "
Total cost—Nov. 1 to Nov. 30.....			6 10 "

TABLE 10.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN VIA NEW WELLAND SHIP CANAL—TRANSFER AT GANANOQUE (FORT WILLIAM TO LIVERPOOL)

Assuming no Return Cargoes

1. *Fort William to Gananoque*—12,000 ton ship—Coaling at Cleveland.

Coal consumed 9.1 days at 42.....	=	382 tons	
" " 3.5 " 6.....	=	21 "	
Stores " 12.6 " 5.....	=	63 "	
Net cargo=12,000 tons less.....	=	466 tons	=11,534 tons
9.1 days on voyage at \$791.....	=	\$7,200	
3.5 days in port at \$611.....	=	2,140	
Insurance—Hull—12.6 days at \$163.....	=	2,050	
Cargo—11,534 tons at 0.05.....	=	577	
Total cost.....	=	\$11,967 per	11,534 tons
Transfer at Gananoque at 1.14c. per bus.....			= \$1 04 per ton
			0 42 "

2. *Gananoque to Montreal*—2,400 ton ship

Coal consumed 3.0 days at 16.....	=	48 tons	
" " 3.25 " 2.5.....	=	8 "	
Stores " 6.25 " 2.....	=	12 "	
Net cargo=2,400 tons less.....	=	68 tons	= 2,332 tons
3.0 days on voyage at \$289.....	=	\$867	
3.25 days in port at \$212.....	=	690	
Insurance—Hull—6.25 days at \$62.....	=	388	
Cargo—2,332 tons at 0.0875.....	=	204	
Total cost.....	=	\$2,149 per	2,332 tons
Transfer at Montreal at 1.14c. per bus.....			= \$0.92 per ton
			= 0.42 "

3. *Montreal to Liverpool*—

As shown on—Table No. 7.....			\$2 53 "
Transfer into warehouse at Liverpool at 9/10c. per bus.....			0 33 "
Total—May 1 to Sept. 30.....			= \$5 66 "
Total—Oct. 1 to Oct. 31.....			= 5 73 "
Total—Nov. 1 to Nov. 30.....			= 5 91 "

TABLE 11.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN VIA NEW WELLAND SHIP CANAL—TRANSFER AT PRESCOTT (FORT WILLIAM TO LIVERPOOL)

Assuming no Return Cargoes

1. *Fort William to Prescott*—12,000 ton ship—Coaling at Cleveland.

Coal consumed 9.3 days at 42.....	=	390 tons	
" " 3.5 " 6.....	=	21 "	
Stores " 12.8 " 5.....	=	64 "	
Net cargo—12,000 tons less.....	=	475 "	=11,525 tons
9.3 days on voyage at \$791.....	=	\$7,355	
3.5 days in port at \$611.....	=	2,140	
Insurance—Hull—12.8 days at \$196.....	=	2,550	
Cargo—11,525 tons at 0.065.....	=	750	
Total cost.....	=	\$12,795 per	11,525 tons
Transfer at Prescott at 1.14c. per bus.....			= \$1 11 per ton
			= 0 42 "

TABLE No. 11—Concluded

2. Prescott to Montreal—2,400 ton ship.

Coal consumed 2.6 days at 16.....	=	42 tons
“ “ 3.25 “ 2.5.....	=	8 “
Stores “ 5.85 “ 2.....	=	12 “

Net cargo=2,400 tons less.....	=	62 tons = 2,338 tons
2.6 days on voyage at \$289.....	=	\$752
3.25 days in port at \$212.....	=	690
Insurance—Hull—5.85 days at \$62.....	=	363
Cargo—2,338 tons at 0.0875.....	=	204

Total cost.....	= \$2,009 per	2,338 tons = \$0 86 per ton
Transfer at Montreal at 1.14c. per bus.....		= 0 42 “

3. Montreal to Liverpool—

As shown on Table No. 7.....		2 53 “
Transfer into warehouse at Liverpool at 9/10c. per bus.....		0 33 “
Total cost—May 1 to Sept 30.....		\$5 67 “
Total cost—Oct. 1 to Oct. 31.....		\$5 74 “
Total cost—Nov. 1 to Nov. 30.....		\$5 93 “

TABLE 12.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN VIA NEW WELLAND SHIP CANAL AND ST. LAWRENCE DEEP WATERWAY—NO TRANSFER—(FORT WILLIAM TO LIVERPOOL)

Assuming no Return Cargoes

1. Fort William to Liverpool—8,500 ton ship—Coaling at Liverpool and Cleveland.

Coal consumed—18.5 days at 35 tons.....	=	648 tons
“ “ 2 “ 5.5 “.....	=	11 “
Stores “ 13.0 “ 16 “.....	=	208 “
“ “ 7.5 “ 5 “.....	=	37 “

Net cargo—8,500 tons less.....	904 “ = 7,596 tons
37.2 days on voyage at \$543.....	= \$20,200
4.0 days in port at \$395.....	= 1,580
Insurance—Hull—(Fort William to Sydney and return)	
18.2 days at \$88.....	= 1,600
(Sydney to Liverpool and return) 22 days at \$37.....	= 815
Cargo—7,596 tons at 0.3375.....	= 2,560
Pilotage.....	= 660

Total cost.....	\$27,415 per	7,596 tons = \$3 62 per ton
Transfer into Warehouse at Liverpool at 9/10c. per bus.....		0 33 “
Total—May 1 to Sept. 30.....		\$3 95 “
Total—Oct. 1 to Oct. 31.....		\$4 03 “
Total Nov. 1 to Nov. 30.....		\$4 21 “

TABLE 13.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN VIA NEW WELLAND SHIP CANAL AND ST. LAWRENCE DEEP WATERWAY—TRANSFER AT MONTREAL—(FORT WILLIAM TO LIVERPOOL)

Assuming no Return Cargoes

1. Fort William to Montreal—12,000 ton ship—Coaling at Cleveland

Coal consumed—11.2 days at 42.....	=	471 tons
“ “ 3.5 “ 6.....	=	21 “
Stores “ 14.7 “ 5.....	=	74 “

Net cargo—12,000 tons less.....	566 “ = 11,434 tons
11.2 days on voyage at \$791.....	= \$8,859
3.5 days in port at \$611.....	= 2,140
Insurance—Hull—14.7 days at \$195.....	= 2,870
Cargo—11,434 tons at .0875.....	= 1,050

Total cost.....	= \$14,919 per	11,434 tons = \$1 31 per ton
Transfer at Montreal at 1.14c. per bus.....		0 42 “

2. Montreal to Liverpool—

As shown on Table 7.....		2 53 “
Transfer into warehouse at Liverpool at 9/10c. per bus.....		0 33 “
Total—May 1 to Sept. 30.....		\$4 59 “
Total—Oct. 1 to Oct. 31.....		\$4 66 “
Total—Nov. 1 to Nov. 30.....		\$4 83 “

TABLE 14.—COST OF TRANSFERRING PACKAGE FREIGHT FROM RAILWAY CARS TO SHIPS AT MONTREAL

Transfer—Freight car to shed.....	\$ 0 25 per ton
Transfer—Shed to ship (stevedoring).....	0 70 "
Shed rental (\$100.00 per day, 8 days, 8,000 tons cargo.....)	0 10 "
Wharfage charge (See Schedule) Sulphur 20c., Sugar 20c., including 4 days storage after ships discharge.....	0 20 "
Switching cars—\$2.50 each, say 40 tons.....	0 04 "
Ship losses due to detention in port 4 days.....	0 36 "
	<u>\$ 1 67</u>

TABLE 15.—COST OF TRANSFERRING BAGGED COMMODITIES SUCH AS FLOUR OR CEMENT FROM CANAL BOAT TO STEAM VESSEL AT MONTREAL

Transfer—Canal boat to shed (stevedoring).....	0 25 per ton
Transfer—Shed to ship (stevedoring).....	0 65 "
Shed rental—\$100 per day, 8 days, 8,000 tons cargo.....	0 10 "
Wharfage charge—Flour 11c., Cement 10c.....	0 10 "
Ship losses due to detention of ocean ship 4 days.....	0 36 "
Ship losses due to detention of canal boat 2 days.....	0 28 "
	<u>\$ 1 74</u>

TABLE 16.—COST OF TRANSFERRING BAGGED FLOUR FROM RAIL TO SHIP OR SHIP TO RAIL AS AT FORT WILLIAM OR PORT McNICOLL

Labour cost of transfer—Ship to car through shed.....	\$ 0 65
Expense of office tally demurrage and watching.....	0 13
Expense of providing shed.....	0 10
Expense of port equipment and power.....	0 10
Ship losses due to detention for unloading—5 days.....	0 41
	<u>\$ 1 39</u>

Compiled from Statistics furnished by various shipping firms.

TABLE No. 17—TABLE SHOWING TONNAGE THROUGH THE CANADIAN AND AMERICAN CANALS AT SAULT STE. MARIE

Year	Up bound			Down bound			Grand Total
	Can. Canal	Am. Canal	Total	Can. Canal	Am. Canal	Total	
1916.....	1,429,646	16,310,155	17,739,801	15,373,354	58,775,064	74,148,418	91,888,219
1917.....	1,610,082	18,157,331	19,767,413	13,841,966	56,204,519	70,046,485	89,813,898
1918.....	1,238,477	18,156,298	19,394,775	11,683,170	54,602,382	66,285,552	85,680,327
1919.....	579,030	14,825,307	15,404,337	3,558,929	49,272,276	52,831,205	68,235,542
1920.....	475,785	15,342,708	15,818,493	2,004,899	61,459,104	63,464,003	79,282,496
1921.....	349,524	15,795,769	16,145,293	1,648,068	30,460,755	32,108,823	48,254,116
1922.....	367,515	10,679,725	11,047,240	1,341,545	53,676,098	55,017,643	66,064,883
1923.....	520,392	19,622,311	20,142,703	1,735,537	69,498,591	71,234,128	91,376,831
1924.....	333,232	14,858,415	15,196,647	1,293,316	55,544,882	56,838,198	72,034,845
1925.....	363,896	14,206,509	14,570,405	1,271,074	66,030,220	67,301,294	81,871,699
1926.....	428,849	15,720,033	16,148,882	994,426	68,538,307	69,532,733	85,681,615

Taken from Canal Statistics published by Dominion Bureau of Statistics.

TABLE No. 18—TABLE SHOWING TRAFFIC THROUGH WELLAND CANAL IN TONS

Year	Upbound	Down-bound	Total
1910.....	724,834	1,601,456	2,326,290
1911.....	842,919	1,694,710	2,537,629
1912.....	825,722	2,026,193	2,851,915
1913.....	1,005,103	2,565,611	3,570,714
1914.....	856,049	3,004,920	3,860,969
1915.....	756,460	2,304,552	3,061,012
1916.....	499,621	2,045,343	2,544,964
1917.....	313,186	2,177,356	2,490,542
1918.....	133,692	1,843,483	1,977,175
1919.....	188,463	1,982,316	2,170,779
1920.....	200,513	2,075,559	2,276,072
1921.....	276,177	2,800,245	3,076,422
1922.....	329,268	3,062,151	3,391,419
1923.....	338,651	3,417,261	3,755,912
1924.....	395,183	4,642,229	5,037,412
1925.....	594,477	5,045,821	5,640,298
1926.....	679,758	4,534,756	5,214,514
1927.....	—	—	7,247,459

Compiled from Canal Statistics published by Dominion Bureau of Statistics—1927, page 52

TABLE 19.—SUMMARY OF TRAFFIC ON THE ST. LAWRENCE CANALS (IN TONS)

Year	Upbound Traffic			Downbound Traffic			Totals		Grand Total
	Can.	U.S.	Total	Can.	U.S.	Total	Can.	U.S.	
1910....	840,124	3,895	844,019	1,135,034	781,699	1,916,733	1,975,158	785,594	2,760,752
1911....	948,188	10,772	958,960	1,115,673	1,031,075	2,146,748	2,063,861	1,041,847	3,105,708
1912....	945,350	13,531	958,881	1,394,793	1,123,514	2,518,307	2,340,143	1,137,045	3,477,188
1913....	1,096,532	7,593	1,104,125	1,735,258	1,463,044	3,198,302	2,831,790	1,470,637	4,302,427
1914....	976,869	9,085	985,954	1,761,780	1,643,759	3,405,539	2,738,649	1,652,844	4,391,493
1915....	822,454	2,083	824,537	1,201,090	1,383,840	2,584,930	2,023,544	1,385,923	3,409,467
1916....	689,052	9,470	698,522	892,143	1,777,399	2,669,542	1,581,195	1,786,869	3,368,064
1917....	554,893	6,528	561,421	821,799	2,007,924	2,829,723	1,376,692	2,014,452	3,391,144
1918....	444,631	6,923	451,554	449,666	2,129,914	2,579,580	894,297	2,136,837	3,031,134
1919....	496,750	11,843	508,593	1,001,572	1,381,454	2,383,026	1,498,322	1,303,297	2,891,619
1920....	594,383	14,371	608,754	690,889	1,768,319	2,459,208	1,285,272	1,782,690	3,067,962
1921....	615,886	4,509	620,395	931,857	2,181,813	3,113,670	1,547,743	2,186,322	3,734,065
1922....	981,130	11,529	992,659	1,668,455	1,658,805	3,327,260	2,649,585	1,670,334	4,319,919
1923....	824,940	20,442	845,382	2,145,360	1,550,786	3,696,146	2,970,300	1,571,228	4,541,528
1924....	934,086	8,670	942,756	2,797,783	1,795,835	4,593,618	3,731,869	1,804,505	5,536,374
1925....	1,298,243	18,235	1,316,478	2,882,235	2,008,275	4,890,510	4,180,478	2,026,510	6,206,988
1926....	1,358,233	116,206	1,474,439	2,992,608	1,656,654	4,649,262	4,350,841	1,772,860	6,123,701
1927....							5,400,615	2,512,337	7,912,952

Compiled from Canal Statistics (Dominion Bureau of Statistics.)

TABLE No. 20—TABLE SHOWING LAKE AND RAIL SHIPMENTS OF WHEAT, WHEAT FLOUR, AND OTHER GRAIN FROM HEAD OF LAKES IN 1,000 BUSHEL FOR CROP YEARS

Crop year	Shipments by water				Shipments by rail			Total Shipments
	Wheat bush.	Wheat flour bush. at 4½	Other grain	Total	Wheat	Other grain	Total	
1917-18.....	99,730	13,230	26,267	139,227	—	—	—	—
1918-19.....	90,432	31,782	17,814	140,028	—	—	—	—
1919-20.....	81,700	12,917	25,335	119,952	12,029	10,313	22,342	129,377
1920-21.....	123,808	9,978	54,995	188,781	17,898	8,244	26,142	214,923
1921-22.....	177,244	14,475	52,014	243,733	12,712	9,694	22,406	266,139
1922-23.....	231,891	16,109	47,988	295,988	18,473	8,876	27,349	323,337
1923-24.....	275,620	20,269	67,826	363,715	8,026	6,626	14,652	378,367
1924-25.....	157,405	17,968	79,633	255,006	7,300	3,224	10,524	265,530
1925-26.....	250,129	18,569	78,562	347,260	7,193	3,695	10,888	358,148

Compiled from Report on the Grain Trade of Canada published by the Dominion Bureau of Statistics.

TABLE 21—TABLE SHOWING CANADIAN WHEAT AND OTHER GRAIN FROM HEAD OF LAKES PASSING THROUGH SAULT STE. MARIE CANALS BY POINTS OF DESTINATION IN BUSHELS

(Fiscal Years)

Year		Montreal	Georgian Bay Ports	Port Colborne and other Can. Ports	Buffalo and other U.S. Ports	Total
1919.....	Wheat.....	563,003	53,793,931	33,090,288	4,127,614	91,574,836
	Other grain.....	3,807,952	11,882,866	8,601,669	4,882,243	29,174,730
	Total.....	4,370,955	65,676,797	41,691,957	9,009,857	120,749,566
1920.....	Wheat.....	849,151	34,494,678	20,743,059	53,880,995	109,967,833
	Other grain.....	2,187,983	9,351,488	4,915,621	4,733,331	21,188,423
	Total.....	3,037,134	43,846,166	25,658,680	58,614,326	131,156,306
1921.....	Wheat.....	933,036	38,322,605	30,252,063	83,962,553	153,470,257
	Other grain.....	3,048,196	32,742,443	13,307,717	8,016,975	57,115,321
	Total.....	3,981,232	71,065,048	43,559,780	91,979,528	210,585,578
1922.....	Wheat.....	2,273,443	40,472,831	54,663,833	129,686,701	227,096,808
	Other grain.....	2,965,243	10,571,694	11,758,867	13,363,182	38,658,986
	Total.....	5,238,686	51,044,525	66,422,700	143,049,883	265,755,794
1923.....	Wheat.....	7,557,935	53,051,040	58,932,559	124,304,529	243,846,063
	Other grain.....	7,793,489	12,917,850	13,646,247	3,960,579	43,323,165
	Total.....	15,356,424	65,968,890	72,578,806	133,265,108	287,169,228
1924.....	Wheat.....	7,297,453	42,737,363	60,163,600	90,345,244	200,543,660
	Other grain.....	5,526,413	25,274,097	9,186,322	25,158,247	65,045,079
	Total.....	12,823,866	68,011,460	69,349,922	115,503,491	265,588,739
1925.....	Wheat.....	12,053,631	45,807,823	39,533,654	128,280,642	225,675,750
	Other grain.....	9,936,762	12,970,432	20,263,029	28,625,586	71,795,809
	Total.....	21,990,393	58,778,255	59,796,683	156,906,528	297,471,559
1926.....	Wheat.....	8,526,874	51,123,230	49,265,045	120,153,330	229,068,479
	Other grain.....	5,853,098	9,188,863	23,385,667	20,544,512	56,972,140
	Total.....	14,379,972	60,312,093	72,650,712	140,697,842	286,040,619

Compiled from Canal Statistics published by Dominion Bureau of Statistics.

TABLE 22—TABLE SHOWING CANADIAN FLOUR FROM HEAD OF LAKES PASSING THROUGH SAULT STE. MARIE CANALS BY POINTS OF DESTINATION IN BARRELS (FISCAL YEARS)

Year	Port McNicoll	Point Edward	Montreal	Total
1917.....	1,999,089	941,100	-	2,940,189
1918.....	4,800,913	2,261,000	-	7,061,913
1919.....	1,954,480	916,000	-	2,870,480
1920.....	1,409,800	606,030	-	2,015,830
1921.....	2,197,495	1,018,590	18,700	3,224,785
1922.....	2,155,050	1,607,220	-	3,762,270
1923.....	2,783,600	1,255,500	-	4,039,100
1924.....	2,993,000	1,473,740	27,630	4,494,370
1925.....	2,637,550	1,201,570	-	3,839,120
1926.....	2,606,580	1,407,570	64,750	4,078,900

Compiled from Canal Statistics published by Dominion Bureau of Statistics.

TABLE 23—EXPORTS OF CANADIAN GRAIN AND WHEAT FLOUR FROM U.S. NORTH ATLANTIC PORTS, MONTREAL AND QUEBEC

In five months and seven months periods

Year	Grain in bushels			Flour in barrels
	5 months, Dec., Jan., Feb., Mar., April	7 months, May, June, July, Aug., Sept., Oct., Nov.	Total grain	
FROM U.S. NORTH ATLANTIC PORTS				
1921.....	28,427,930	29,996,302	58,424,232	2,039,394
1922.....	60,923,228	51,191,096	112,114,324	3,770,401
1923.....	52,554,304	63,115,280	115,669,584	4,548,348
1924.....	63,873,361	53,051,757	116,925,118	5,471,699
1925.....	44,697,236	68,417,324	113,114,560	5,160,428
1926.....	72,523,354	48,274,193	120,797,547	4,048,152
FROM MONTREAL AND QUEBEC				
1921.....	907,594	55,052,737	55,960,331	649,610
1922.....	2,656,890	71,073,544	73,730,434	1,422,857
1923.....	952,342	82,026,576	82,978,918	1,239,115
1924.....	943,797	86,184,149	87,127,946	1,406,902
1925.....	980,904	81,374,794	82,355,698	687,552
1926.....	5,254,419	82,853,709	88,108,128	1,465,974
TOTAL				
1921.....	29,335,524	85,049,039	114,384,563	2,689,004
1922.....	63,580,118	122,264,640	185,844,758	5,193,258
1923.....	53,506,646	145,141,856	198,648,502	5,787,463
1924.....	64,817,158	139,235,906	204,053,064	6,878,601
1925.....	45,678,140	149,792,118	195,470,258	5,847,980
1926.....	77,777,773	131,127,902	208,905,675	5,514,126

Compiled from information obtained from Dominion Bureau of Statistics.

TABLE 23A—EXPORTS OF UNITED STATES GRAIN FROM UNITED STATES NORTH ATLANTIC PORTS, MONTREAL AND QUEBEC
In Five Months and Seven Months Periods

Year	Grain in bushels		
	5 months, Dec., Jan., Feb., Mar., April	7 months, May, June, July, Aug., Sept., Oct., Nov.	Total grain
FROM U.S. NORTH ATLANTIC PORTS			
1921.....	79,267,014	60,291,659	139,558,673
1922.....	52,874,220	110,648,476	163,522,696
1923.....	46,294,041	24,162,511	70,456,552
1924.....	12,460,974	45,380,165	57,841,139
1925.....	46,365,134	23,911,710	70,276,844
1926.....	26,918,153	27,110,068	54,028,221
FROM MONTREAL AND QUEBEC			
1921.....	—	76,587,528	76,587,528
1922.....	1,468,703	74,484,751	75,953,454
1923.....	708,785	33,005,337	33,714,122
1924.....	708,785	66,297,713	67,006,498
1925.....	1,114,862	50,226,901	51,341,763
1926.....	1,234,389	33,629,999	34,864,388
TOTAL			
1921.....	79,267,014	137,279,187	216,546,201
1922.....	54,342,923	155,133,227	239,476,150
1923.....	47,002,826	57,167,848	104,170,674
1924.....	13,169,759	111,677,878	124,847,637
1925.....	47,479,996	74,138,611	121,618,607
1926.....	28,152,542	60,740,067	88,892,609

Compiled from Statistics furnished by Dominion Bureau of Statistics.

TABLE 24.—EXPORTS OF CANADIAN WHEAT AND OTHER GRAINS OVERSEAS BY ROUTE (in 1,000 bushels)

Crop Year	Pacific ports	U. S. Atlantic ports	Montreal and Quebec	Other Canadian Atlantic ports	Total wheat and other grains
1920-21					
Wheat.....	573	54,086	25,825	6,476	86,960
Other grain.....	-	9,907	26,241	3,344	39,492
Total.....	573	63,993	52,066	9,820	126,452
1921-22					
Wheat.....	7,837	100,009	28,231	6,605	142,682
Other grain.....	142	18,268	19,467	3,892	41,769
Total.....	7,979	118,277	47,698	10,497	184,451
1922-23					
Wheat.....	17,830	129,871	57,031	12,014	216,746
Other grain.....	384	23,822	17,465	4,283	45,953
Total.....	18,214	153,693	74,496	16,297	262,700
1923-24					
Wheat.....	53,810	141,069	63,568	9,423	267,870
Other grain.....	1,971	29,380	17,047	6,996	55,394
Total.....	55,781	170,449	80,615	16,419	323,264
1924-25					
Wheat.....	23,922	75,071	39,099	5,695	143,787
Other grain.....	1,179	36,195	27,438	3,183	67,995
Total.....	25,101	111,266	66,537	8,878	211,782
1925-26					
Wheat.....	52,955	142,174	58,166	11,798	265,093
Other grain.....	450	32,843	35,701	4,152	73,146
Total.....	53,405	175,017	93,867	15,950	338,239

Compiled from the "Grain Trade of Canada" published by the Dominion Bureau of Statistics.

TABLE 25.—EXPORTS OF CANADIAN WHEAT, WHEAT FLOUR, AND OTHER GRAINS BY COUNTRIES OF DESTINATION

Flour reduced to bushels at 4½ bushels to barrel
(In 1,000 bushels)

Crop Year	To United States	To China and Japan	To United Kingdom	To other Countries	Totals
1920-21					
Wheat.....	49,214	—	34,758	52,202	136,174
Flour.....	5,657	27	16,314	8,991	30,989
Other grains.....	6,117	—	27,517	11,975	45,609
Total.....	60,988	27	78,589	73,168	212,772
1921-22					
Wheat.....	15,868	3,516	112,419	26,747	158,550
Flour.....	3,057	454	20,643	11,294	35,448
Other grains.....	4,841	—	29,606	12,163	46,610
Total.....	23,766	3,970	162,668	50,204	240,608
1922-23					
Wheat.....	12,936	3,853	174,287	38,606	229,682
Flour.....	1,947	2,260	21,140	24,464	49,811
Other grains.....	3,946	—	37,571	8,383	49,900
Total.....	18,829	6,113	232,998	71,453	329,393
1923-24					
Wheat.....	21,320	14,818	202,571	50,481	289,190
Flour.....	830	3,415	18,506	31,208	53,959
Other grains.....	8,681	—	45,022	10,372	64,075
Total.....	30,831	18,233	266,099	92,061	407,224
1924-25					
Wheat.....	3,171	3,149	115,775	24,863	146,958
Flour.....	76	777	12,083	32,827	45,763
Other grains.....	5,715	—	47,213	20,782	73,710
Total.....	8,962	3,926	175,071	78,472	266,431
1925-26					
Wheat.....	10,464	20,618	198,402	46,073	275,557
Flour.....	76	5,765	15,158	23,036	49,035
Other grains.....	3,504	—	46,227	26,919	76,650
Total.....	14,044	26,383	259,787	101,028	401,242

Compiled from the "Grain Trade of Canada" published by the Dominion Bureau of Statistics.

TABLE 26.—PRODUCTION AND EXPORTS OF WHEAT FROM CANADA AND UNITED STATES (in 1,000 bushels)

Year	Canada		United States	
	Production	Exports	Production	Exports
1909.....	166,744	49,325	683,379	48,389
1910.....	132,049	46,329	635,121	24,207
1911.....	230,924	60,348	621,338	32,601
1912.....	224,159	84,781	730,267	61,526
1913.....	231,717	129,680	763,380	99,302
1914.....	161,280	70,156	891,017	173,499
1915.....	393,543	151,584	1,025,801	205,498
1916.....	262,781	190,820	636,318	153,729
1917.....	233,743	146,874	636,655	106,196
1918.....	189,075	55,054	921,438	111,177
1919.....	193,260	69,057	967,979	148,086
1920.....	263,189	123,060	833,027	218,287
1921.....	300,858	146,855	814,905	280,058
1922.....	299,786	209,339	867,598	164,692
1923.....	474,199	242,815	797,394	98,534
1924.....	262,097	214,631	864,428	166,302
1925.....	411,376	222,345	676,429	86,526
1926.....	409,811	—	832,305	—

Compiled from "Grain Trade of Canada" published by the Dominion Bureau of Statistics.

TABLE 27.—TABLE SHOWING THE AVERAGE PRODUCTION OF WHEAT PER CAPITA AND AVERAGE EXPORTS OF WHEAT AND WHEAT FLOUR PER CAPITA OF THE UNITED STATES FOR TEN YEAR PERIODS FROM 1870 TO DATE

Year	Population	Production	Production per capita	Exports	Exports per capita
	(thousands)	(1,000 bush)	bush.	(1,000 bush)	bush.
1870.....	36,558	247,000	6.40	44,073	1.14
1880.....	50,156	419,940	8.37	124,600	2.48
1890.....	62,948	466,900	7.43	139,400	2.22
1900.....	75,994	591,000	7.78	171,000	2.25
1910.....	91,972	702,500	7.65	124,704	1.47
1920.....	105,710	801,607	7.58	225,346	2.51

Compiled from Agricultural Year Books, published by Dept. of Agriculture of U.S.A.

TABLE 28.—TABLE SHOWING THE AVERAGE PRODUCTION OF WHEAT PER CAPITA AND THE AVERAGE EXPORTS OF WHEAT AND WHEAT FLOUR PER CAPITA OF CANADA FOR TEN YEAR PERIODS FROM 1871 TO DATE

Year	Population	Production	Production per capita	Exports	Exports per capita
	(thousands)	(1,000 bush.)	bush.	(1,000 bush.)	bush.
1871.....	3,689	16,724	4.54	-	-
1881.....	4,325	32,350	7.48	3,247	0.75
1891.....	4,833	42,223	8.75	5,637	1.17
1901.....	5,731	75,500	14.05	17,842	3.31
1911.....	7,207	181,770	25.00	73,858	10.30
1921.....	8,788	338,390	38.20	195,553	22.24

Compiled from "The Canada Year Book."

TABLE 29.—TABLE SHOWING THE AVERAGE PRODUCTION AND EXPORTS PER CAPITA OF GRAIN OTHER THAN WHEAT OF CANADA FOR TEN YEAR PERIODS FROM 1871 TO DATE

Year	Population	Production	Production per capita	Exports	Exports per capita
	(thousands)	(1,000 bush.)	bush.	(1,000 bush.)	bush.
1871.....	3,689	72,705	19.67	-	-
1881.....	4,325	117,111	27.08	10,757	2.48
1891.....	4,833	133,323	27.55	6,318	1.31
1901.....	5,731	172,226	32.06	7,757	1.41
1911.....	7,207	417,825	58.10	15,297	2.11
1921.....	8,788	601,135	68.50	50,080	5.70

Compiled from "The Canada Year Book."

TABLE 30.—STATEMENT SHOWING TRAFFIC THROUGH MANCHESTER, SUEZ AND PANAMA CANALS

Year	Manchester	Suez	Panama
	cargo tons	net tonnage	cargo tons
1916.....	-	12,325,347	3,094,114
1917.....	-	8,368,918	7,058,563
1918.....	-	9,251,601	7,532,031
1919.....	-	16,013,802	6,916,621
1920.....	4,387,363	17,574,657	9,374,499
1921.....	3,293,670	18,118,999	11,599,214
1922.....	4,273,544	20,743,245	10,834,910
1923.....	-	22,730,162	19,567,875
1924.....	5,435,508	25,115,881	26,994,710
1925.....	5,881,691	26,772,155	23,958,836
1926.....	6,830,879	-	26,037,448

Compiled from Whitaker's Almanac and Panama Canal Records (Official publication of Panama Canal.)

TABLE 31.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN FROM EDMONTON TO LIVERPOOL VIA PANAMA CANAL

Assuming no return cargoes

(a) *Time of Navigation—*

1. <i>Vancouver to Liverpool and return</i> (Ocean tramp 8,500 tons)			
16,314 miles at 11 m.p.h.....	=	1,483 hrs.	
Through Panama canal.....	=	26 "	
Total.....		1,509 "	= 63 days
Terminal time=2+2+1.....			5 "
Total time—Vancouver to Liverpool.....			68 "

2. *Balboa to Vancouver and return.—*

8,090 miles at 11 m.p.h..... = 736 hrs. = 31 days

(b) *Cost—*1. *Rail—Edmonton to Vancouver.—*

Rail haul—769 miles at 48c. + 15% per 100 ton miles.....=\$4 24
 Turn around at Vancouver..... 40
 Transfer charge at Vancouver at 1c. per bus..... 0 37

2. *Balboa to Vancouver and return—*

Coal consumed 31 days at 35 = 1,085 tons
 " " 3 " 5.5..... = 16 "
 Store " 15.5 " 16 = 248 "
 Net cargo=8,500 tons less..... 1,349 tons = 7,151 tons

3. *Vancouver to Liverpool and return—*

Cost—voyage—63 days at \$543.....=\$34,209
 Cost—port— 5 days at \$395..... = 1,975
 Insurance—Hull—68 days at \$37..... = 2,516
 Insurance—Cargo 7,151 tons at .175..... = 1,251

Total cost.....=\$39,951 per 7,151 tons = 5 58
 Panama tolls at \$1.20 per net vessel tonnage (return trip light)..... = 80

Total—May 1 to Sept. 30.....=\$11 39
 Total—Oct. 1 to Oct. 31.....=\$11 45
 Total—Nov. 1 to Nov. 30.....=\$11 62

TABLE 32.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN FROM EDMONTON TO LIVERPOOL VIA FORT WILLIAM AND EXISTING CANALS

Assuming no Return Cargoes

(1) *Rail Haul—Edmonton to Fort William—*

1,230 miles at 48c. per 100 ton mile.....=\$ 5 91
 Turn around charge at Fort William..... 0 40
 Transfer charge at Fort William at 1c. per bus..... 0 37

(2) *Fort William to Liverpool—See Table 7.....*

5 87

Total cost—May 1 to Sept. 30.....\$ 12 55
 Total cost—Oct. 1 to Oct. 31..... 12 63
 Total cost—Nov. 1 to Nov. 30..... 12 81

TABLE 33.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN FROM EDMONTON TO LIVERPOOL VIA FORT WILLIAM AND NEW WELLAND SHIP CANAL—TRANSFER AT GANANOQUE

Assuming no Return Cargoes

(1) *Rail haul—Edmonton to Fort William—*

1,230 miles at 48c. per 100 ton mile.....\$ 5 91
 Turn around charge at Fort William..... 0 40
 Transfer charge at Fort William at 1c. per bus..... 0 37

(2) *Fort William to Liverpool—*

See Table No. 10..... 5 66

Total—May 1 to Sept. 30.....\$ 12 34
 Total—Oct. 1 to Oct. 31.....\$12 41
 Total—Nov. 1 to Nov. 30.....\$12 59

TABLE 34.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN FROM EDMONTON TO LIVERPOOL VIA FORT WILLIAM, NEW WELLAND SHIP CANAL AND ST. LAWRENCE DEEP WATERWAY—NO TRANSFER AT MONTREAL

Assuming no return cargoes

(1) Edmonton to Fort William—	
Rail haul—1,230 miles at 48c. per 100 ton miles.....	\$ 5 91
Turn around charge at Fort William.....	0 40
Transfer charge at Fort William at 1c. per bus.....	0 37
(2) Fort William to Liverpool—No transfer—	
See Table No. 12.....	3 95
Total cost—May 1 to Sept. 30.....	\$10 63
Total cost—Oct. 1 to Oct. 31.....	\$10 71
Total cost—Nov. 1 to Nov. 30.....	\$10 89

TABLE 35.—STATEMENT SHOWING COST OF TRANSPORTATION OF GRAIN FROM EDMONTON TO LIVERPOOL VIA FORT WILLIAM—NEW WELLAND SHIP CANAL AND ST. LAWRENCE DEEP WATERWAY—TRANSFER AT MONTREAL

Assuming no Return Cargoes

(1) Edmonton to Fort William—	
Rail haul—1,230 miles at 48c. per 100 ton miles.....	\$ 5 91
Turn around charge at Fort William.....	0 40
Transfer charge at Fort William.....	0 37
(2) Fort William to Liverpool—Transfer at Montreal—	
See Table No. 13.....	4 59
Total cost—May 1 to Sept. 30.....	\$ 11 27
Total cost—Oct. 1 to Oct. 31.....	\$ 11 34
Total cost—Nov. 1 to Nov. 30.....	\$ 11 51

TABLE 36.—TABLE SHOWING DIMENSIONS OF STANDARD CARGO SHIPS AS DETERMINED FROM AVERAGES OF THOSE LISTED IN RECENT YEARS

Gross tonnage	Length	Breadth	Mid-ship Draft (salt water)	D.W. carrying capacity
	Feet	Feet	Feet	Tons
2,000.....	294	38.3	18.2	3,200
3,000.....	337	44.0	20.7	4,800
3,760.....	362	74.1	22.2½	6,000
4,000.....	370	48.2	22.75	6,400
5,000.....	398	51.8	24.5	8,000
5,500.....	408	52.9	25.25-25.75	8,735
6,000.....	418	54.0	26.0	9,600
8,000.....	467	60.8	28.7	12,800

TABLE 37.—TABLE SHOWING ESTIMATED CARRYING CAPACITY SHIPS BUILT IN THE 12 LEADING COUNTRIES OF THE WORLD AND STILL AFLOAT IN 1913-1923 AND 1924

Gross register	Draft approximate	Number of ships, 1913	Gross Tons		Per cent	Total per cent	Number of ships, 1923	Gross register	Per cent	Total per cent	Number of ships, 1924	Gross register	Per cent	Total per cent
			Average	Total, 1913										
100- 200	-	4,833	150	724,950	1.6	1.6	4,704	705,600	1.2	1.2	4,731	710,000	1.2	1.2
200- 500	-	4,407	350	1,542,450	3.4	5.0	5,602	1,960,700	3.3	4.5	5,484	1,920,000	3.2	4.4
500-1,000	-	2,853	750	2,139,750	4.9	9.9	2,787	2,090,250	3.5	8.0	2,693	2,020,000	3.4	7.8
1,000-1,500	17.0	2,217	1,250	2,771,250	6.4	16.3	2,035	2,543,750	4.2	12.2	1,989	2,485,000	4.1	11.9
1,500-2,000	19.0	1,594	1,750	2,785,000	6.4	22.7	1,417	2,480,000	4.1	16.3	1,400	2,450,000	4.0	15.9
2,000-3,000	20.7	2,343	2,500	5,860,000	13.4	36.1	2,635	6,580,000	10.9	27.2	2,414	6,030,000	10.0	25.9
3,000-4,000	22.75	2,227	3,500	7,800,000	17.9	54.0	1,899	6,620,000	11.0	38.2	1,763	6,170,000	10.3	36.2
4,000-5,000	24.5	1,523	4,500	6,860,000	15.7	69.7	1,500	6,760,000	11.2	49.4	1,469	6,610,000	11.0	47.2
5,000-6,000	25.8	755	5,500	4,150,000	9.5	79.2	1,834	10,100,000	16.7	66.1	1,822	10,000,000	16.6	63.8
6,000-8,000	28.7	635	7,000	4,445,000	10.3	89.5	1,671	11,700,000	19.4	85.5	1,658	12,750,000	21.2	85.0
8,000-10,000	30.7	174	9,000	1,566,000	3.6	93.1	431	3,879,000	6.4	91.9	438	3,942,000	6.6	91.6
10,000-15,000	-	161	12,500	2,010,000	4.7	97.8	265	3,310,000	5.5	97.4	249	3,110,000	5.2	96.8
15,000-20,000	-	29	17,500	507,000	1.2	99.0	48	840,000	1.3	98.7	51	893,000	1.5	98.3
20,000-25,000	-	9	22,500	203,000	0.46	99.5	20	450,000	0.7	99.4	22	495,000	0.8	99.1
25,000	-	7	30,000	210,000	0.48	100.0	12	360,000	0.6	100.0	11	330,000	0.5	99.6
	-	-	-	43,574,400	-	-	-	60,379,000	-	-	-	59,915,000	-	-

Compiled from Lloyd's Register of Shipping.

TABLE 38.—POTENTIAL STUDY (OF U.S. EXPORTS)

Commodity		Total Exports		Shipped between May and November	Originating in tributary States	Potential traffic expressed in tons	
		Quantity	Value			Quantity	Per cent
Threshers.....	No.	5,490	4,976,750	80-0	3,977	3,182	58-0
Wheel tractors.....	"	17,558	9,826,768	61-4	12,872	7,903	45-2
Mowers.....	"	79,430	2,172,228	46-4	45,504	21,113	26-6
Plows.....	"	142,739	3,606,437	56-4	50,736	28,615	20-0
Other implements.....	lbs.	44,882,770	6,329,651	55-0	27,096,609	6,697	33-5
Dairy machinery.....	"	1,811,266	707,092	55-6	796,030	198	24-4
Pneumatic casings.....	"	26,256,400	15,653,482	62-0	19,827,340	5,488	46-8
Solid tires.....	"	10,211,760	2,195,328	56-3	8,410,440	2,114	46-4
Automobile parts—							
For assembly.....	"	240,210,852	42,375,266	46-3	218,835,158	45,234	42-2
For replacement.....	"	86,866,829	21,965,198	59-4	65,593,420	17,489	45-1
Meat products.....	"	1,553,071,400	257,284,743	55-0	1,241,088,600	304,732	44-0
Wheat flour.....	bbls.	16,985,880	128,951,000	57-0	5,341,800	266,422	17-9
Iron and steel sheets, galvanized.....	lbs.	217,452,385	10,570,642	63-2	57,655,790	16,267	16-7
Steel bars.....	"	288,795,050	8,966,204	55-4	84,515,059	20,902	16-2
Casing and oil line pipe.....	"	169,881,545	8,009,972	54-1	31,875,767	7,699	10-1
Welded black pipe.....	"	161,748,948	6,616,660	47-1	26,456,824	5,563	7-7
Refined copper.....	"	746,947,346	104,288,116	58-6	173,473,275	45,382	13-6
Barbed wire.....	"	144,800,247	6,411,485	63-7	9,117,505	2,593	4-0
Tin plate.....	"	263,112,345	14,896,978	51-1	41,878,406	9,554	0-8
Glucose.....	"	182,519,333	5,414,854	59-4	65,056,413	17,252	21-2
Steel sheets, black (iron and steel plates).....	"	375,396,953	14,239,017	66-1	134,005,623	39,544	23-6
Wheat.....	tons	4,596,050	312,294,950	72-0	3,151,550	2,400,000	52-0
Automobiles and trucks.....	No.	150,687	106,088,534	55-8	105,637	88,448	39-1

Copied from "Great Lakes-to-Ocean Waterways." Domestic Commerce Series No. 4, 1927. Published by U.S. Bureau of Foreign and Domestic Commerce.

TABLE 39.—POTENTIAL STUDY (OF U.S. IMPORTS)

Commodity	Total imports		Shipped between May and November	Tributary States imports	Potential traffic	
	Quantity	Value			Quantity	Per cent
	Pounds		Per cent	Pounds	Tons	
Rubber.....	740,088,684	\$210,434,026	61-0	482,538,023	131,405	40-0
Coffee.....	1,354,416,251	185,680,632	57-5	451,372,083	115,872	19-2
Tea.....	92,873,646	23,741,348	63-1	30,957,882	8,721	21-0
Newsprint.....	2,463,562,610	90,543,959	57-9	551,152,000	142,463	13-0
Wood pulp.....	2,819,532,800	63,198,704	60-7	400,514,240	108,532	8-6

Copied from "Great Lakes-to-Ocean Waterways" Domestic Commerce Series No. 4, published by U.S. Department of Foreign and Domestic Commerce.

TABLE 40.—ANNUAL SHIPMENTS OF GRAIN ON THE GREAT LAKES

Year	Wheat	Other grain	Total grain
1926.....	299,488,428	131,243,352	430,731,780
1925.....	305,266,054	184,146,191	489,412,245
1924.....	343,992,685	199,654,871	543,647,556
1923.....	302,491,589	108,261,567	410,753,156
1922.....	311,939,980	197,471,151	509,411,131
1921.....	239,709,161	221,428,039	461,137,200
1920.....	155,587,661	75,533,166	231,120,827
1919.....	151,073,097	67,726,348	218,799,445
1918.....	166,564,457	77,426,932	243,991,389
1917.....	188,921,956	79,196,500	268,118,456
1916.....	232,584,610	115,902,143	348,486,753
1915.....	272,987,292	118,436,205	391,423,497
1914.....	212,486,824	122,503,694	334,990,518
1913.....	221,827,305	158,071,977	379,899,282
1912.....	193,319,247	107,568,004	300,887,251

TABLE 41—ANNUAL SHIPMENTS OF GRAIN ON THE GREAT LAKES BY PORTS

Year	Chicago and So. Chicago	Milwaukee	Manitowoc	Duluth Superior	Fort William Port Arthur
1926.....	50,030,000	9,299,162	853,000	75,219,138	295,330,480
1925.....	41,885,000	7,923,520	1,002,418	133,178,733	305,422,574
1924.....	74,036,000	17,918,379	1,495,781	177,744,554	272,452,842
1923.....	35,016,000	7,883,094	581,400	70,401,302	296,871,360
1922.....	97,062,000	18,079,691	4,455,523	115,717,302	274,096,899
1921.....	125,904,455	31,096,475	3,643,000	75,989,013	224,504,257
1920.....	24,273,000	11,589,541	171,664	61,549,289	142,061,490
1919.....	43,787,244	6,931,065	538,528	44,123,950	126,923,636
1918.....	68,842,269	17,431,766	1,868,500	75,481,599	79,348,733

Annual Report—Lake Carriers Association—1926, page 113.

TABLE 42—ANNUAL SHIPMENTS OF GRAIN ON THE GREAT LAKES BY KINDS

Year	Wheat	Corn	Oats	Rye	Barley	Flax
1926.....	299,488,428	19,579,683	46,367,227	17,238,358	39,873,093	8,184,991
1925.....	305,266,054	17,137,601	85,619,558	19,997,591	46,946,980	14,444,461
1924.....	343,992,685	27,529,176	64,902,413	52,039,618	36,736,223	18,447,441
1923.....	302,491,589	20,695,494	36,352,471	24,569,086	18,301,361	8,343,155
1922.....	311,939,980	75,753,473	51,094,439	47,391,683	17,616,554	5,614,984
1921.....	239,709,161	102,081,410	74,661,566	18,197,671	17,512,548	8,974,844
1920.....	162,214,922	11,100,608	22,404,180	29,742,290	10,895,857	3,287,127
1919.....	155,853,099	616,917	26,267,749	16,195,400	22,151,658	2,293,015
1918.....	167,717,891	3,236,600	53,311,204	8,797,206	7,370,579	4,849,474
1917.....	188,921,956	3,798,808	44,700,525	3,752,607	13,116,067	8,542,036

Annual Report—Lake Carriers Association—1926, page 113.

TABLE 43A.—GRAIN RECEIPTS, MONTREAL, 1923

Month	Rail Receipts						Water Receipts		Total Receipts, Bushels
	Cars			Bushels			Vessels	Bushels	
	C.N.R.	C.P.R.	Total	C.N.R.	C.P.R.	Total			
January.....	59	44	103	99,707	74,358	174,065	—	—	174,065
February.....	54	21	75	80,903	31,461	112,364	—	—	112,364
March.....	52	59	111	84,283	95,629	179,912	—	—	179,912
April.....	1,331	60	1,391	1,924,010	42,681	1,966,691	—	—	1,966,691
May.....	3,064	2,474	5,538	4,429,126	4,843,329	9,272,455	115	7,278,892	16,551,347
June.....	3,621	2,913	6,534	5,234,291	5,702,755	10,937,046	144	9,931,452	20,868,498
July.....	1,200	535	1,735	1,734,645	1,047,365	2,782,010	183	11,693,737	14,475,747
August.....	693	123	816	1,001,757	240,796	1,242,553	198	13,073,652	14,316,205
September.....	564	641	1,205	815,283	1,254,880	2,070,163	201	13,215,588	15,285,751
October.....	4,196	2,893	7,089	6,065,475	5,663,602	11,729,077	145	8,715,365	20,444,442
November.....	1,769	1,156	2,925	2,557,155	2,263,091	4,820,246	142	9,368,522	14,188,768
December.....	46	63	109	66,495	123,355	189,850	19	1,354,369	1,544,199
Total.....	16,649	10,982	27,631	24,093,130	21,383,282	45,476,412	1,147	74,631,578	120,107,990

Compiled from Statistics furnished by Harbour Commissioners of Montreal.

DEVELOPMENT OF ST. LAWRENCE RIVER

335

TABLE 43B.—GRAIN RECEIPTS, MONTREAL, 1924

Month	Rail Receipts						Water Receipts		Total Receipts Bushels
	Cars			Bushels			Vessels	Bushels	
	C.N.R.	C.P.R.	Total	C.N.R.	C.P.R.	Total			
January.....	20	74	94	34,965	129,370	164,335	—	—	164,335
February.....	32	74	106	53,040	122,654	175,694	—	—	175,694
March.....	36	35	71	56,436	54,868	111,304	—	—	111,304
April.....	60	161	221	106,957	320,173	427,130	17	1,225,153	1,652,283
May.....	1,462	1,559	3,021	2,606,191	3,100,309	5,706,500	234	17,041,007	22,747,507
June.....	931	597	1,528	1,659,619	1,187,225	2,846,844	243	16,846,154	19,692,998
July.....	145	83	228	258,480	165,058	423,538	244	16,457,380	16,880,918
August.....	1	18	19	1,783	35,796	37,579	186	12,993,838	13,031,417
September.....	2,646	1,817	4,463	4,716,813	3,613,381	8,330,194	227	16,239,135	24,569,329
October.....	5,895	5,967	11,862	10,508,516	11,866,288	22,374,804	241	16,347,169	38,722,003
November.....	3,150	2,777	5,927	5,615,254	5,522,487	11,137,741	189	13,077,986	24,215,727
December.....	391	345	736	697,004	686,087	1,383,091	25	1,792,793	3,175,884
Total.....	14,769	13,507	28,276	26,315,088	26,803,696	53,118,784	1,606	112,020,615	165,139,399

Compiled from Statistics furnished by the Harbour Commissioners of Montreal.

TABLE 43C.—GRAIN RECEIPTS, MONTREAL, 1925

Month	Rail Receipts						Water Receipts		Total Receipts Bushels
	Cars			Bushels			Vessels	Bushels	
	C.N.R.	C.P.R.	Total	C.N.R.	C.P.R.	Total			
January.....	82	72	154	116,267	102,088	218,355	—	—	218,355
February.....	29	23	52	41,612	33,002	74,614	—	—	74,614
March.....	14	10	24	22,828	16,305	39,133	—	—	39,133
April.....	655	537	1,192	1,306,038	1,080,460	2,385,498	13	1,223,617	3,609,115
May.....	2,469	1,317	3,816	4,919,297	2,710,203	7,629,500	221	17,676,286	25,305,786
June.....	1,705	342	2,047	3,397,084	688,114	4,085,198	187	14,007,116	18,092,314
July.....	411	531	942	818,887	1,068,387	1,887,274	246	17,589,268	19,476,542
August.....	151	348	499	300,856	700,186	1,001,042	279	20,627,314	21,628,356
September.....	473	621	1,094	942,417	1,249,470	2,191,887	225	16,728,060	18,919,947
October.....	3,512	2,921	6,433	6,997,396	5,877,136	12,874,532	264	18,459,799	31,334,331
November.....	1,607	1,505	3,112	3,201,826	3,028,103	6,229,929	179	16,530,903	22,760,832
December.....	127	52	179	253,038	104,626	357,664	23	1,984,736	2,342,400
Total.....	11,235	8,309	19,544	22,316,546	16,658,080	38,974,626	1,637	124,827,099	163,801,725

Compiled from Statistics furnished by Harbour Commissioners of Montreal.

TABLE 43D.—GRAIN RECEIPTS, MONTREAL, 1926

Month	Rail Receipts						Water Receipts		Total Receipts Bushels
	Cars			Bushels			Vessels	Bushels	
	C.N.R.	C.P.R.	Total	C.N.R.	C.P.R.	Total			
January.....	65	36	101	96,048	51,588	147,636	-	-	147,636
February.....	49	38	87	74,877	63,581	138,458	-	-	138,458
March.....	42	40	82	60,610	56,121	116,731	-	-	116,731
April.....	116	69	185	215,118	128,591	343,709	-	-	343,709
May.....	1,377	2,793	4,170	2,595,835	5,367,138	7,962,973	192	14,918,111	22,881,084
June.....	1,291	1,530	2,821	2,526,661	2,929,517	5,456,178	289	21,277,019	26,733,197
July.....	535	479	1,014	1,011,344	935,683	1,947,027	223	17,198,296	19,145,323
August.....	69	442	511	93,050	858,790	951,840	157	11,009,425	11,961,265
September.....	419	915	1,334	717,831	1,786,321	2,504,152	215	13,810,301	16,314,453
October.....	1,335	1,615	2,950	2,581,002	2,934,901	5,515,903	212	13,649,909	19,165,812
November.....	1,437	1,581	3,018	2,638,457	2,807,383	5,445,840	175	12,156,306	17,602,146
December.....	192	219	411	329,884	362,827	692,711	8	655,357	1,348,068
Total.....	6,927	9,757	16,684	12,940,717	18,282,441	31,223,158	1,471	104,674,724	135,897,882

Compiled from Statistics furnished by Harbour Commissioners of Montreal.

SPECIAL COMMITTEE

TABLE 44.—TABLE SHOWING TOTAL GRAIN AND FLOUR EXPORTS FROM CANADA AND UNITED STATES IN BUSHELS

Year	Canada	United States	Total
1926-27.....	347,027,500	274,878,500	621,906,000
1925-26.....	401,241,853	204,463,000	605,704,853
1924-25.....	266,431,697	352,525,000	618,956,697
1923-24.....	411,340,339	211,458,059	622,798,398
1922-23.....	328,603,476	406,909,754	735,513,230
1921-22.....	235,761,403	527,209,352	762,970,755
1920-21.....	207,482,425	508,827,912	716,310,337
1919-20.....	123,850,690	338,037,885	461,888,575
1918-19.....	138,444,225	462,258,261	600,702,486
1917-18.....	211,533,988	330,095,851	541,629,839
1916-17.....	257,502,321	389,286,984	646,789,305
1915-16.....	336,897,655	421,539,265	758,436,920
1914-15.....	107,866,374	520,003,815	627,870,189
1913-14.....	197,083,486	167,083,594	364,167,080
1912-13.....	192,543,762	246,805,062	439,348,824
1911-12.....	113,126,707	121,513,772	234,640,479
1910-11.....	83,973,126	146,404,355	230,377,481
1909-10.....	61,788,171	131,728,367	193,516,538
1908-09.....	64,253,330	161,316,057	225,569,387

Canadian—"Bureau of Statistics" United States—"Annual Reports—New York Produce Exchange."

TABLE 45.—TABLE SHOWING MONTHLY MOVEMENTS OF IRON ORE ON THE GREAT LAKES

(Tons)

Months	Years							
	1919	1920	1921	1922	1923	1924	1925	1926
April.....	1,412,239	230,854	176,211	136,161	14,184	659,387	2,120,715	9,664
May.....	6,615,341	6,976,085	2,594,027	1,585,305	6,671,705	6,583,815	8,313,984	6,113,584
June.....	7,980,839	9,233,566	3,600,989	6,629,711	9,499,502	7,583,926	7,958,486	8,770,551
July.....	9,173,429	9,638,606	4,047,687	8,942,336	10,411,248	7,280,014	8,531,250	10,006,093
August.....	4,423,133	9,270,763	4,329,158	9,016,426	10,295,806	6,689,799	8,532,718	10,009,290
September.....	9,171,550	8,923,482	3,913,122	6,801,299	9,096,584	6,164,936	7,354,873	9,621,756
October.....	6,201,883	8,848,986	3,233,081	6,081,386	8,099,442	5,596,648	7,004,443	9,337,774
November.....	3,152,319	5,305,738	406,451	3,410,934	4,938,249	2,056,141	4,257,612	3,946,662
December.....	46,662	99,146	—	9,626	9,894	8,906	7,217	22,511
Totals.....	47,177,395	58,527,226	22,300,726	42,613,184	59,036,704	42,623,572	54,081,298	58,537,855

Taken from Annual Reports—Lake Carriers Association.

TABLE 46.—TABLE SHOWING THE MONTHLY MOVEMENTS OF SOFT COAL ON THE GREAT LAKES

(Tons)

Months	Years							
	1919	1920	1921	1922	1923	1924	1925	1926
April.....	1,082,183	301,572	1,242,772	802,641	1,105,074	889,248	1,693,794	1,015,864
May.....	3,631,851	1,195,732	3,559,895	1,303,281	3,829,871	2,433,862	2,799,833	3,916,350
June.....	4,098,828	2,069,546	4,638,309	1,474,634	4,698,061	2,747,125	3,237,919	4,586,282
July.....	3,804,423	2,686,888	3,554,686	755,437	4,653,109	3,418,436	3,726,343	4,394,753
August.....	2,703,271	4,408,788	2,932,101	825,225	4,359,850	3,554,221	3,981,283	3,843,264
September.....	2,360,667	3,941,867	2,200,473	4,396,284	3,416,936	3,184,289	3,229,676	3,310,697
October.....	3,075,613	4,486,434	2,722,633	4,600,427	3,918,764	3,382,112	3,893,616	3,328,079
November.....	956,505	3,319,528	1,541,511	4,364,213	3,559,585	2,961,110	3,294,469	3,276,516
December.....	—	—	—	—	115,307	371,581	473,910	487,271
Totals.....	21,713,341	22,408,355	22,412,380	18,522,142	29,656,557	22,941,974	26,330,843	28,159,076

Taken from Annual Reports—Lake Carriers Association.

TABLE 47—TABLE SHOWING COMPARISON OF FREIGHT HANDLED BY CANADIAN STEAM RAILWAYS WITH FREIGHT HANDLED ON ST. LAWRENCE CANALS

Year	Total freight handled (a) by Canadian Steam Railways		Total freight originating in (b) Canada handled on St. Lawrence Canals		Total freight handled on (b) St. Lawrence Canals	
	Total freight in 1,000 tons	Percent increase	Total freight in 1,000 tons	Percent increase	Total freight in 1,000 tons	Percent increase
1902.....	42,376	0	937	0	1,093	0
1903.....	44,373	5	1,292	38	1,681	54
1904.....	48,097	14	1,018	9	1,427	30
1906.....	57,906	37	1,295	38	1,636	50
1908.....	63,071	49	1,261	35	2,009	84
1910.....	74,483	76	1,973	111	2,760	152
1912.....	89,444	112	2,340	150	3,477	218
1914.....	106,393	152	2,738	193	4,391	300
1916.....	109,659	160	1,581	69	3,368	208
1918.....	127,543	200	919	— 2	3,031	177
1920.....	127,429	200	1,285	37	3,067	181
1922.....	108,530	157	2,650	183	4,319	295
1923.....	118,289	180	2,970	217	4,542	315
1924.....	106,429	152	3,731	299	5,536	406
1925.....	119,850	160	4,180	346	6,206	468
1926.....	122,476	190	4,350	364	6,123	460
1927.....	121,616	188	5,347	470	7,913	623

(a) Taken from Statistics of Steam Railways of Canada. (Dominion Government Publication).

(b) Taken from Canal Statistics. (Dominion Government Publication).

TABLE 48—TABLE SHOWING ANNUAL CHARGES AND BENEFITS FROM DEEP WATERWAYS PROJECT

(25 feet depth)

Scheme—Chrysler Isd. Project in International Rapids Section. Hungry Bay—Melocheville Project in Soulanges Section

A. Overall Cost.

Section	First cost	Interest during construction and market- ing period
Thousand Islands.....	\$ 1,100,000	\$ 55,000
International Rapids.....	271,814,000	72,164,000
Lake St. Francis.....	980,000	25,000
Soulanges.....	33,640,000	2,555,000
Lachine.....	53,000,000	6,890,000
Total.....	360,534,000	81,689,000
		<u>\$442,223,000</u>

B. Annual Charges of St. Lawrence Project, assuming upper lake channels improved for upper lake navigation free of charge to St. Lawrence Project—

Interest on 1st cost—5 per cent on \$360,534,000.....	= \$18,027,000
Interest on interest during construction—5 per cent on \$81,689,000.....	= 4,085,000
Operation and Maintenance—	
Navigation works.....	935,000
Power works.....	1,432,000
Depreciation—	
Power house machinery.....	742,000
Other works.....	1,432,000
Total.....	<u>\$ 26,653,000</u>

C. Annual Benefits of St. Lawrence Project in addition to those from Welland Ship Canal—

Power—Firm power—1,900,000 h.p. at \$15.00.....	= \$ 28,500,000
Additional summer power—300,000 h.p. at \$7.50.....	= 2,250,000
Savings in transportation costs—	
Canadian traffic. For details, see Para. 58.....	15,000,000
United States' traffic. For details, see Para. 87.....	22,200,000
Total benefits.....	<u>\$67,950,000</u>

WELLAND SHIP CANAL

D. *Annual Charges.*

Interest on 1st cost—5 per cent on \$115,000,000.....	= \$ 5,750,000
Interest on interest during construction—5 per cent on \$25,000,000.....	= 1,250,000
Operation and maintenance=\$1,000,000—\$600,000.....	= 400,000
Total annual charges—W.S.C.....	= \$ 7,400,000

E. *Saving in Transportation Costs by Welland Alone*..... \$ 1,000,000

TABLE 49—TABLE SHOWING ANNUAL CHARGES AND BENEFITS FROM NAVIGATION WORKS ONLY

(25 feet Depth)

A. *Overall Cost—*

Section	First cost	Interest during construction period	
Thousand Islands.....	\$ 1,100,000	\$ 55,000	
International Rapids—			
Navigation works only.....	34,350,000	4,465,000	
Lake St. Francis.....	980,000	25,000	
Soulanges.....	33,640,000	2,555,000	
Lachine.....	53,000,000	6,890,000	
Total.....	\$ 123,070,000	\$ 13,990,000	\$137,060,000

B. *Annual Charges, St. Lawrence Project—*

Interest on 1st cost—5 per cent on \$123,070,000.....	= \$ 6,154,000
Interest on interest during construction—5 per cent on \$13,990,000.....	= 700,000
Operation and maintenance.....	935,000
Depreciation.....	615,000
Total.....	\$ 8,404,000

C. *Annual Benefits, St. Lawrence Project—*

Savings in transportation costs—	
Canadian traffic—for details, see par. 58.....	15,000,000
United States' traffic—for details see par. 87.....	22,200,000
Total benefits.....	\$ 37,200,000

WELLAND SHIP CANAL

D. *Annual Charges—*

Interest on 1st cost—5 per cent on \$115,000,000.....	= \$ 5,750,000
Interest on interest during construction—5 per cent on \$25,000,000.....	= 1,250,000
Operation and maintenance=\$1,000,000—\$600,000.....	= 400,000
Total annual charges—W.S.C.....	= \$ 7,400,000

E. *Saving in Transportation Costs, Welland alone*..... \$ 1,000,000



O N T A R I O

M I N N E S O T A

W I S C O N S I N

M I C H I G A N

PORT ARTHUR
FT. WILLIAM

THUNDER BAY

Keweenaw Bay

ISLE ROYAL

BLACK BAY

APOSTLE ISLANDS

Michigan I.

Cuttyhunk I.

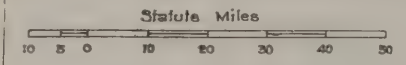
WHITEFISH BAY

SAULT ST. MARIE
ONT.

IROQUOIS PT.
MICH.

LAKE SUPERIOR

COURSE:- Port Arthur to Iroquois Point = 258 Miles



EXISTING NAVIGATION

possible ALL CANADIAN NAVIGATION COURSE
Port Arthur to Iroquois Point = 258 Miles
NAVIGATION COURSE

INTERNATIONAL BOUNDARY

DULUTH

SUPERIOR

O N T A R I O

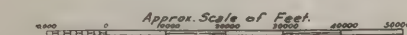


ST MARYS RIVER

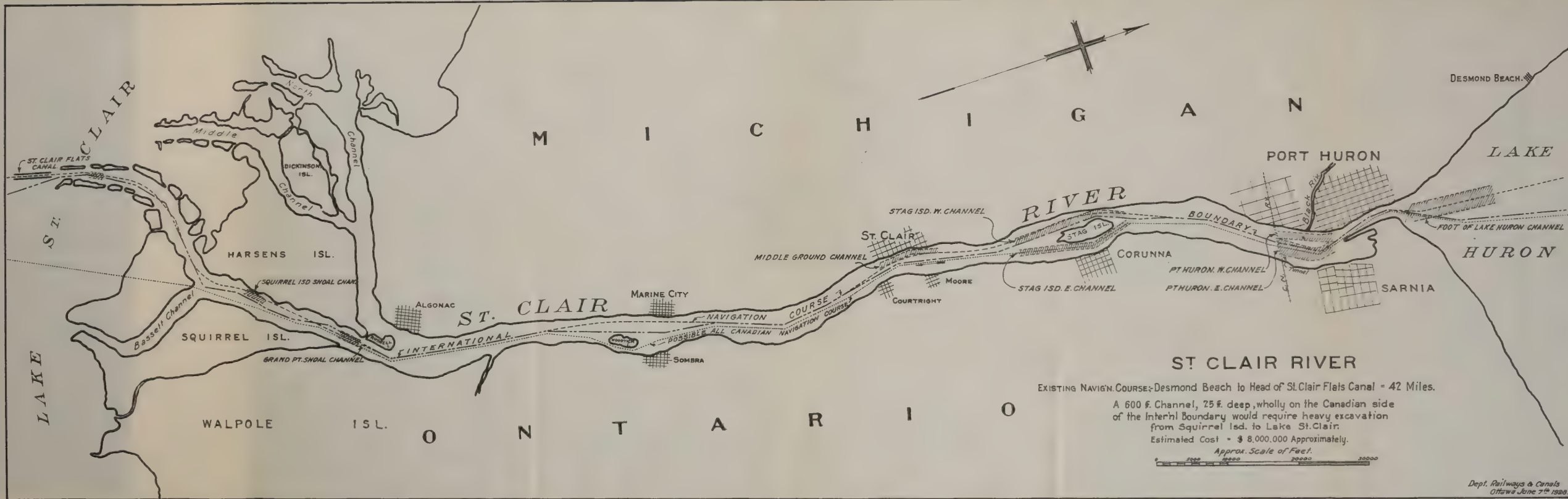
EXISTING NAV'N COURSE:- Pt. Iroquois to Pt. Detour = 63.6 Miles.

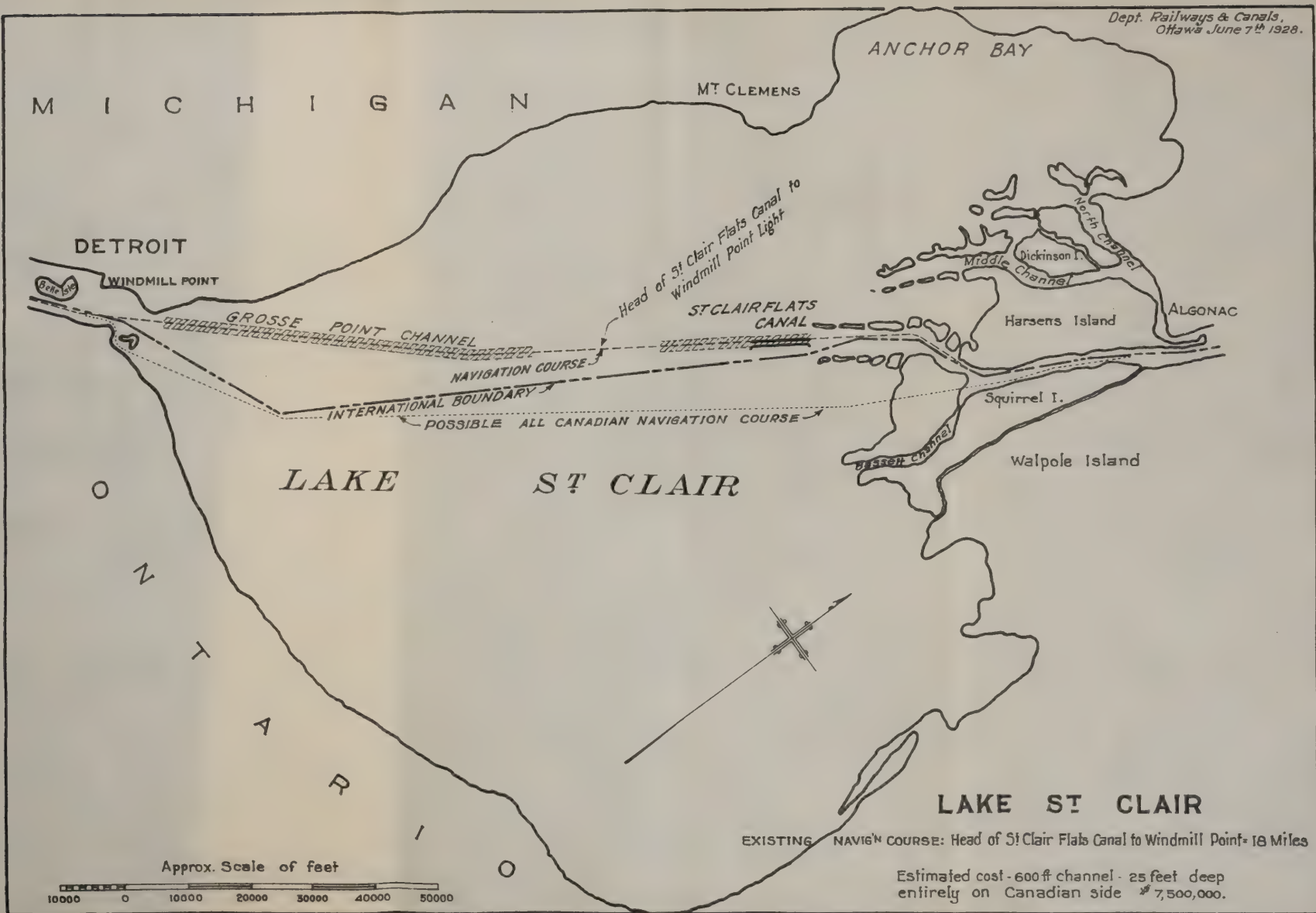
NOTE:- A 600 ft. Channel, 25 ft. deep, wholly on the Canadian side of the Inter'l Boundary, from Lake Superior to Lake Huron, would require heavy excavation North of Sugar Isl. and would have to pass North of St. Joseph and Drummond Islands.

Estimate Cost = \$108,500,000 Approximately.



M I C H I G A N







M I C H I G A N

WYANDOTTE

TRENTON

GROSSE ISLE

FIGHTING ISD CHANNEL

FIGHTING ISD.

DETROIT RIVER

DETROIT

WINDMILL POINT

WINDSOR

INTERNATIONAL

LIVINGSTONE CHANNEL

AMHERSTBURG CHANNEL

AMHERSTBURG

BOIS BLANC

O N T A R I O

LAKE ERIE

LAKE ST. CLAIR

DETROIT RIVER

EXISTING NAVIG. COURSE - Windmill Point to Lake Erie = 31.6 Miles.

NOTE - A 600 f. Channel, 25 ft. deep, wholly on the Canadian side of the Internal Boundary would require heavy excavation at Fighting Isd.

Estimated Cost = \$ 23,000,000 Approximately.

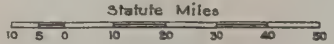
Approx. Scale of Feet.
0 5000 10000 20000 30000





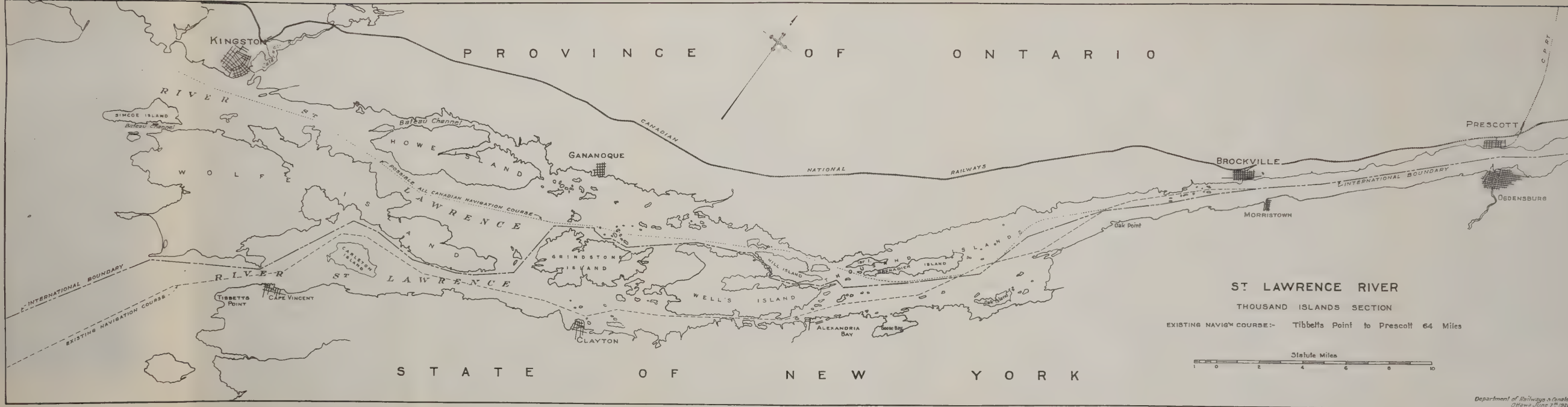
LAKE ERIE - LAKE ONTARIO

EXISTING NAVIG ⁿ COURSE :-	LAKE ERIE - Detroit River to Port Colborne	219. Miles
" "	LAKE ONTARIO - Port Dalhousie to Tibbetts Point	158.25 "



Dep^t Railways & Canals.
Ottawa June 7th 1914.

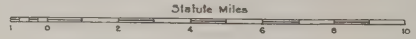


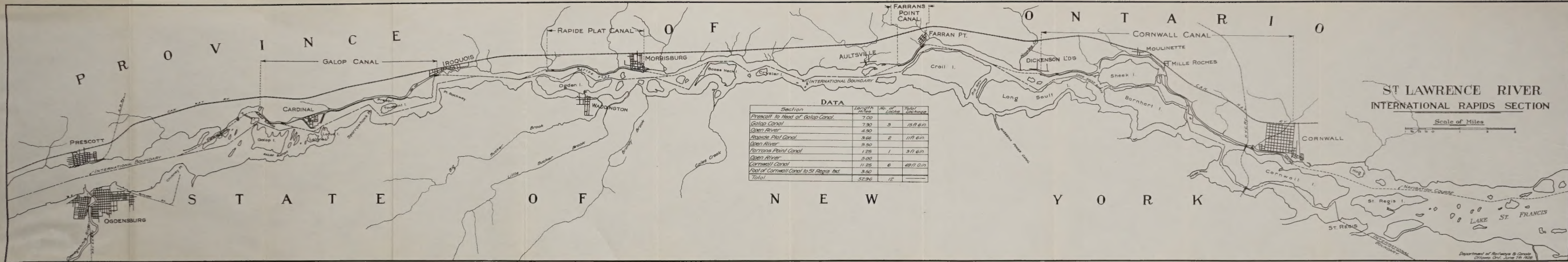


ST. LAWRENCE RIVER

THOUSAND ISLANDS SECTION

EXISTING NAVIGⁿ COURSE:- Tibbetts Point to Prescott 64 Miles





9 fold maps
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369316

Gov. Doc. Canada. St. Lawrence River, Special Committee on
Can the Development and Improvement of the
Com Proceedings.

5

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